Chapter 4: Phosphorus Source Controls for the Basins Tributary to the Everglades Protection Area

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SUMMARY

This chapter provides the Water Year 2006 (WY2006) (May 1, 2005 through April 30, 2006) update on the phosphorus source control strategies for areas tributary to the Everglades Protection Area (EPA). The following 10 basins discharge to the EPA: Everglades Agricultural Area (EAA), C-139, C-11 West, North New River Canal (NNRC), North Springs Improvement District (NSID), Feeder Canal, L-28, C-111, Village of Wellington's (VOW) ACME Improvement District, and Boynton Farms. A source control strategy has been developed for each basin consistent with the requirements of the Everglades Forever Act (EFA) and the Long-Term Plan. The strategy includes implementation of Best Management Practices (BMPs) for phosphorus reduction, regulatory programs, educational programs, and integration with local and regional projects. The South Florida Water Management District (SFWMD or the District) is required to monitor and report on the progress of these strategies.

The source control strategy for the basins tributary to the Everglades Construction Project (ECP), which include the EAA and C-139 basins, relies on an EFA-mandated regulatory program that requires BMP implementation and specific phosphorus load limits in discharges from the basins. The EAA basin must achieve a 25 percent reduction in total phosphorus (TP) load in any given water year (since WY1996) when compared to a pre-BMP baseline period. For WY2006, the EAA basin achieved a 44 percent reduction, which exceeded the 25 percent requirement for the eleventh consecutive year.

Planned activities for the EAA basin consist of continuing the current level of BMP implementation as mandated in the Long-Term Plan and improving the understanding of the relationships between Lake Okeechobee inflows, EAA basin runoff, and downstream points of entry into Stormwater Treatment Areas (STAs) along with the driving factors that govern those relationships. The District will continue to rely on the findings and recommendations made by the University of Florida Institute of Food and Agricultural Sciences for improving BMP effectiveness at the farm level through research and enhanced extension services.

The C-139 basin must maintain TP loads leaving the basin in any given water year (since WY2003) at or below pre-BMP baseline period levels. For WY2006, the C-139 basin did not meet this requirement. WY2006 was characterized by an active hurricane season across South Florida; however, impacts were minimal in most source control program basins, with the

exception of the C-139 basin. Hurricane Wilma in October 2005, and to a greater extent active storm activity occurring during June and July 2005, produced significantly higher amounts of runoff and elevated TP concentrations from the C-139 basin than in the previous water year. The hurricane's impact to agricultural operations in the C-139 basin during the active growing season was reported by farmers to have resulted in wide spread crop damage and erosion. Although elevated levels of concentrations were observed during the period immediately after the hurricane, the levels during the June and July time period were much greater and provided a larger contribution to the runoff TP load observed during the wet season.

Because it is the fourth year that the C-139 basin did not meet the TP load requirement, the District is required to initiate rulemaking pursuant to Chapter 120, Florida Statutes, to ensure that the objectives of the EFA are met. In addition to BMPs, continuation of supplemental source control activities and investigations initiated in WY2006 or earlier, will provide valuable information for program improvements:

- BMP research on phosphorus application rates and phosphorus cycling and transport
- Development of a hydraulic and hydrology model to evaluate on-farm and regional water quality improvement projects
- Expansion and optimization of the upstream monitoring network to identify areas of concern with regard to TP load contribution, including flow monitoring and phosphorus speciation forms
- Monitoring of BMPs funded by the C-139 and Western Basins Grant Program
- Solicitation of landowner input for water quality improvement activities

The strategy for the non-ECP basins, which include C-11 West, NNRC, NSID, Feeder Canal, L-28, C-111, VOW, and Boynton Farms, is to develop voluntary BMP programs (initiated in WY1998) and to rely on future Comprehensive Everglades Restoration Plan (CERP) projects and other local construction projects for impoundment or diversion of flows. Because of the relatively small contribution of TP loads from these basins compared to the ECP basins, there is not a specific load limit mandated. The EFA requires implementation of schedules and strategies to ensure progress toward ultimately achieving established water quality standards. Water Quality Improvement Plans (WQIPs) for each non-ECP basin have been developed to control TP at the source and include a combination of voluntary BMPs; public information and education; modification of storm water system permits to include water quality criteria; construction projects; cooperative agreements; and basin-specific regulatory programs.

The District monitors the discharges from each non-ECP basin to evaluate the effectiveness of the source control strategies. For WY2006, approximately 54.2 metric tons (mt) of TP load was discharged by non-ECP basins to the EPA. The majority of TP load was from the Feeder Canal and L-28 basins (comprised of primarily agricultural land use), which together contributed 41.2 mt TP, or 76 percent, of the total non-ECP basin load. WY2006 produced the highest annual TP load on record for the Feeder Canal Basin and the second highest load for the L-28 basin. Unusually heavy rainfall events during the period June through August 2005 coincide with the high flows and loads discharged.

Analysis of TP concentrations in WY2006 continues to indicate a wide variation between non-ECP basins. In two basins, Feeder Canal and L-28, as well as the urbanized VOW basin, the observed TP flow-weighted mean concentration was 50 parts per billion (ppb) or higher. The C-11 West basin and the C-111 basin TP levels were between 10 and 20 ppb. There was no flow

from the NNRC or NSID basins to the EPA in WY2006. No water quality samples were collected in WY2006 for the Boynton Farms basin due to minimal pumping occurring during the growing season.

Planned activities for the non-ECP basins include continued implementation of the existing WQIPs for each non-ECP basin; coordination of CERP and local construction projects; and requesting amendments to the Long-Term Plan to reflect current construction project schedules and to recommend extending the funding for source control activities to FY2010 to account for construction delays. For the Feeder Canal basin in particular, planned activities include monitoring TP levels to evaluate trends and contributing factors and reviewing individual storm water system permits within the basin to optimize implementation of water quality improvement measures.

Results from TP data collected during WY2006 for each ECP and non-ECP basin are summarized in **Table 4-1**. Of the 313.7 mt of runoff TP load generated by the combined ECP and non-ECP basins, the ECP basins accounted for 83 percent of the total runoff load. For the ECP basins, runoff is generally directed to STAs for treatment before entering the EPA. Therefore, the TP load summary for the ECP basins should not be confused with the TP load that actually enters the EPA after treatment. For the non-ECP basins, runoff entering the EPA does not currently undergo treatment in an STA; however, CERP projects for the VOW basin and District plans for the C-139 Annex (an area within the L-28 basin) include additional features to direct runoff from non-ECP basins to an STA prior to discharge into the EPA.

Continued implementation of the BMP mandatory programs in the EAA and C-139 basins, continued implementation of the WQIPs for the non-ECP basins, and achievement of the required levels of performance in TP loading from these basins are necessary for the District to achieve the phosphorus criterion in the EPA and fulfill its obligations under the EFA and the federal Everglades Settlement Agreement. The EAA is meeting the required performance levels of the EFA and maintenance of those levels is critical to continued success; however, refinement of the mandated program and supplementary activities are needed in the C-139 basin to achieve the EFA required level of performance. Although there is not a specific load limit mandated by the EFA for the non-ECP basins, continued implementation of BMPs is necessary to ensure progress toward ultimately achieving established water quality standards until future CERP and local construction projects to impound or divert discharges are completed.

Table 4-1. Summary of Everglades Construction Project and non-Everglades Construction Project (ECP and non-ECP) basin discharge total phosphorus (TP) concentrations (flow-weighted mean, or FWM) and loads for Water Year 2006 (WY2006).

Basin[1]	ECP or non-ECP	Primary Land Use	FWM TP Concentration (ppb)	TP Load (mt)
Everglades Agricultural Area (EAA)	ECP	Agricultural	119	152.6
C-139	ECP	Agricultural	260	106.9
C-11 West	non-ECP	Urban	18	4.3
North New River Canal (NNRC)	non-ECP	Urban	(no flow)[2]	(no flow)[2]
North Springs Improvement District (NSID)	non-ECP	Urban	(no flow)[2]	(no flow)[2]
Feeder Canal	non-ECP	Agricultural	155	28.7
L-28	non-ECP	Agricultural	50	12.5
C-111	non-ECP	Urban	13	5.5
ACME Improvement District (VOW)	non-ECP	Urban/Equine	97	3.2
Boynton Farms	non-ECP	Agricultural	(N/A)[3]	(N/A)[3]

[1] ECP basin discharges receive further treatment downstream through the STAs prior to discharge to the EPA.

[2] No discharges from NSID and NNRC basins to the EPA during WY2006.

[3] No instrumentation in place for flow monitoring from this area.

INTRODUCTION

The long-term Everglades water quality goal is to meet water quality standards and goals established by the Everglades Forever Act (EFA), including compliance with the phosphorus criterion in the Everglades Protection Area (EPA) utilizing a Long-Term Plan (LTP) (Burns & McDonnell, 2003) that consists of an optimal combination of source control strategies, Stormwater Treatment Areas (STAs), Advanced Treatment Technologies, and integration with Comprehensive Everglades Restoration Plan (CERP) projects. Chapter 8 of this volume provides further information on the Long-Term Plan. The restoration program incorporates a strong science base and an adaptive implementation philosophy to allow continuous improvement until the long-term water quality goal is achieved. Controlling phosphorus at the source is the foundation of the water quality improvement component of the Everglades Restoration Program.

The South Florida Water Management District (SFWMD or the District) has identified 10 basins with discharges tributary to the EPA (**Figure 4-1**). The background and details of the source control programs for these basins are described in Chapter 3 of the *2006 South Florida Environmental Report – Volume I*, including the requirements for implementing Best Management Practice (BMP) Plans, Discharge Monitoring Plans, and Water Quality Improvement Plans; research and demonstration projects; data evaluation; compliance methodologies and determinations; and education and outreach activities.

To assure compliance with the EFA, the District must comply with specific source control requirements stipulated in permits issued by the Florida Department of Environmental Protection (FDEP). These permits are the Everglades Construction Project (ECP) and the non-Everglades Construction Project (non-ECP) permits. Both permits incorporate a comprehensive approach for controlling phosphorus, including implementation of BMPs utilizing regulatory, cooperative, and educational programs. The District is required by permit to report on the results of these programs annually.

The ECP permits require the District to construct, maintain, and operate the ECP in the Everglades Agricultural Area (EAA) and C-139 basins, the largest tributary sources to the EPA. The ECP permits regulate the construction and operation of the STAs and require the District to provide reasonable assurance that the EAA and C-139 basins are complying with a mandated phosphorus source control program for discharges to the STAs. Permit requirements for these basins mandate a minimum level of BMP implementation through a regulatory program. Further, the Long-Term Plan stipulates that the District perform activities designed to maintain and improve upon the contribution of source controls to the overall water quality improvement goals in the basins. This chapter provides Water Year 2006 (WY2006) (May 1, 2005 through April 30, 2006) total phosphorus (TP) results for the ECP basins and an update on the progress of their regulatory and Long-Term Plan required activities. Chapter 5 of this volume provides an update on STA performance, compliance, and optimization as required by the ECP permit.

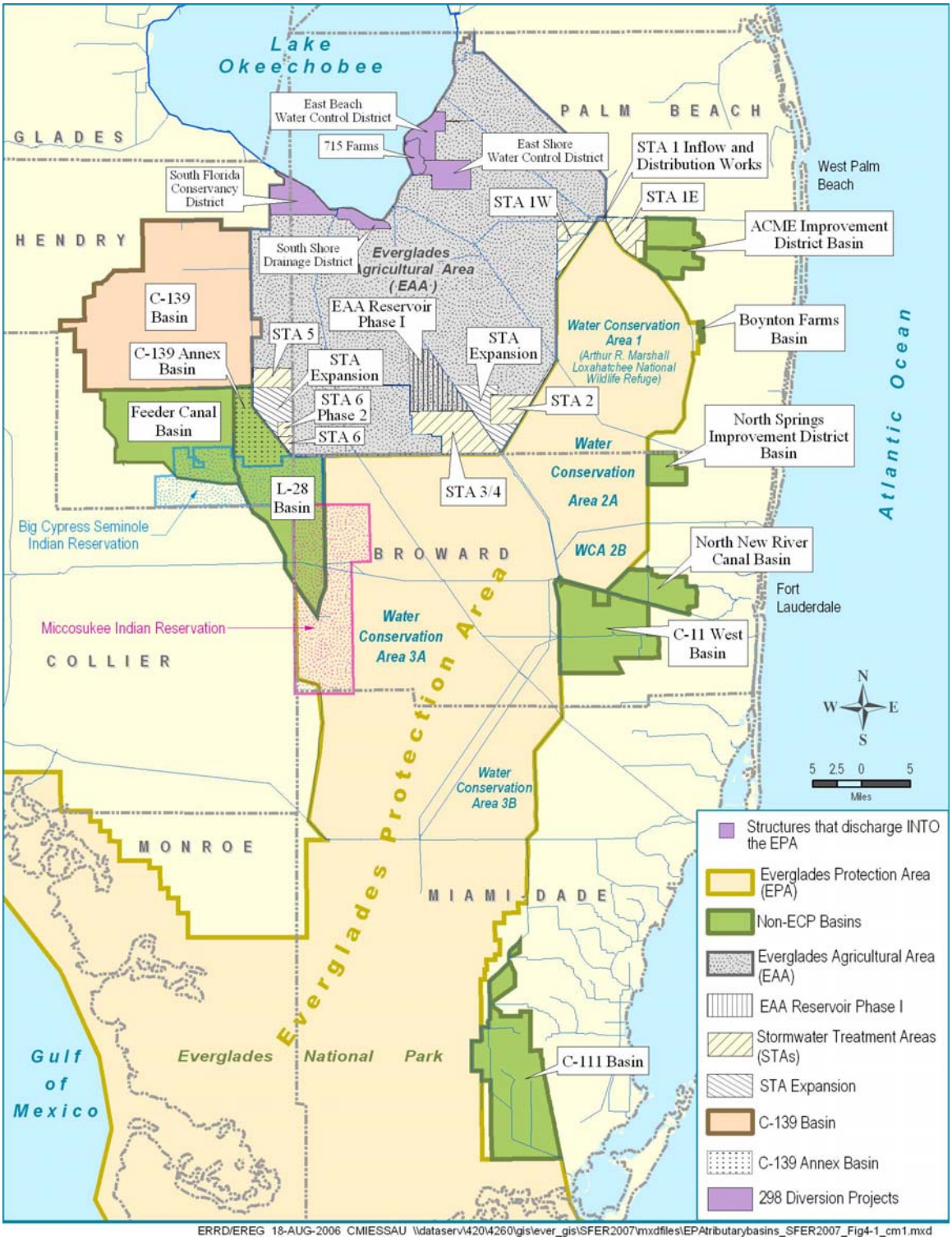


Figure 4-1. ECP and non-ECP basins tributary to the Everglades Protection Area.

The non-ECP permit regulates the operation and maintenance of water control structures, within the control of the District, that discharge into, within, or from the EPA and are not included in the ECP. The non-ECP permit requires evaluation of water quality standards for the EPA as well as descriptions of schedules and strategies to ensure progress toward ultimately achieving established water quality standards in discharges from the permitted basins to the EPA. This chapter provides an update for the comprehensive schedules and strategies for phosphorus reduction described in Water Quality Improvement Plans (WQIPs) developed for each non-ECP basin. The WQIPs utilize source control programs that combine the implementation of BMPs through cooperative arrangements, requirement of water quality criteria in local permits, and full integration with CERP and other local construction projects. TP data is presented in this chapter to evaluate the success of the WQIPs. While this chapter focuses on TP reduction in non-ECP basin discharges, Chapter 3A and associated appendices provide an updated comprehensive evaluation of water quality as required by non-ECP permit conditions.

There are eight basins discharging directly to the EPA that are not part of the ECP. Five of these basins have "into" structures that are operated and maintained by the District and are permitted under the non-ECP permit: C-11 West, North New River Canal (NNRC), Feeder Canal, L-28, and C-111 basins. There are three remaining non-ECP basins that discharge directly to the EPA but are not permitted under the non-ECP permit because the discharge structures are not owned or operated by the District: Village of Wellington's (VOW) ACME Improvement District, North Springs Improvement District (NSID), and Boynton Farms. These basins have privately owned and operated structures that discharge to the EPA; however, pursuant to the EFA and Long-Term Plan, the District has implemented source control programs in each of these basins through development of WQIPs equivalent to those required under the non-ECP permit.

SOURCE CONTROLS IN THE ECP BASINS

The EFA mandates specific TP annual load limits in the discharges leaving the EAA and the C-139 basins. These limits are based on historic data or "baseline periods" defined by law. TP load limits from the tributary basins are critical to the success of the ECP because STAs were designed based on historic data. It is the source control program's implementation of mandated BMPs in the EAA and C-139 basins that reduce TP loads in discharges from the basins prior to inflow to an STA. Detailed information regarding the development of BMP and Discharge Monitoring plans for each ECP basin can be found in Chapter 3 of the 2006 SFER – Volume I. This chapter provides an update on the WY2006 data and the source control activities for the EAA and C-139 basins.

EAA BASIN UPDATE

The EFA specifies that the EAA basin shall achieve a reduction of the TP loads discharged from the basin by 25 percent when compared to the pre-BMP baseline period. The EFA also requires the District to collect monitoring data from the EAA basin at representative locations to evaluate the effectiveness of the BMPs in achieving and maintaining compliance with the TP load reduction requirement. These requirements are outlined in Chapter 40E-63, Florida Administrative Code (F.A.C.) (Rule 40E-63). If the EAA basin is determined to be out of compliance based on District-collected data, then the data collected by the permittee under an approved discharge monitoring plan is used as a secondary compliance method to determine individual farm TP load contributions. There is not a provision in the rule for use of the permittee's regulatory data for determining compliance as long as the basin-level data show that the TP load reduction requirement is met. Because the EAA basin has met and exceeded the 25 percent reduction requirement each year since the program's inception, the secondary compliance method has not been utilized; however, the permittee's data are reported in Appendix 4-2 for informational purposes. An EAA basin map and the representative monitoring locations for determining WY2006 compliance with the TP load reduction requirement is shown in **Figure 4-2**.

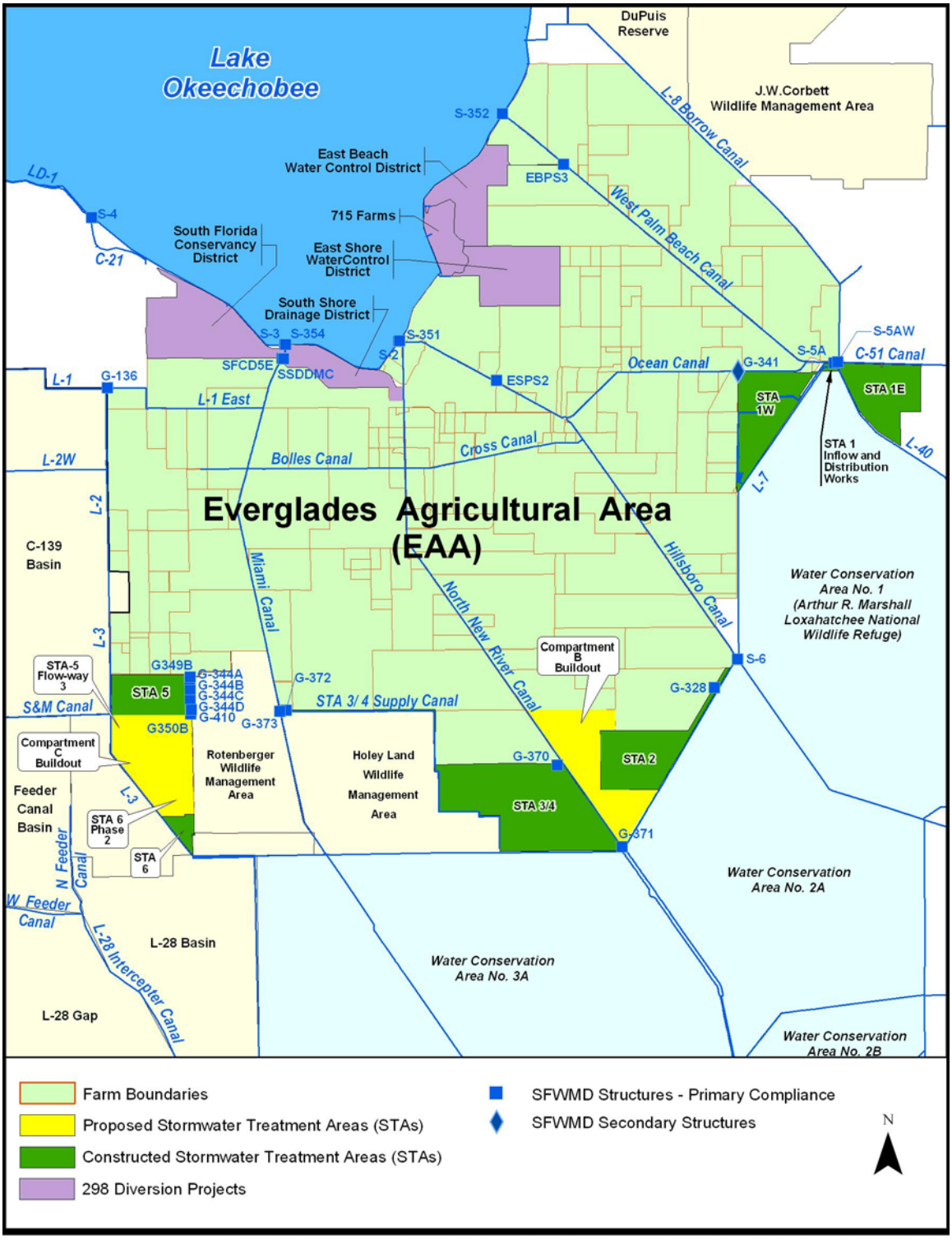


Figure 4-2. The EAA basin and primary compliance water control structures within the ECP boundary.

Water Year 2006 Phosphorus Results for the EAA Basin

The EAA basin is in compliance for WY2006, having exceeded the 25 percent TP load reduction requirement for the eleventh consecutive year since the first compliance determination in WY1996. **Table 4-2** provides a summary of the WY2006 results for the total observed and predicted TP loads, where the observed load is the measured load based on samples collected during the water year, and the predicted load is the pre-BMP baseline period load adjusted for hydrologic variability associated with rainfall. Compliance is determined by comparing the observed TP load for the current water year to the predicted load from the pre-BMP base period. The comparison for WY2006 shows that the EAA basin achieved a 44 percent TP load reduction.

Table 4-2. Results of WY2006 EAA basin TP compliance calculations.

WY2006 EAA TP Load	
Estimated TP load from the EAA during the baseline period years adjusted for WY2006 rainfall amount and distribution (WY1980–WY1988)[1]	270 mt
Actual WY2006 TP load from the EAA with BMPs implemented	153 mt
WY2006 TP load reduction (relative difference)	44%
Three-year average TP load reduction	56%

WY2006 EAA TP Concentration	
Actual annual average EAA TP concentration prior to BMP implementation (WY1980–WY1988)[1]	172 ppb
Actual WY2006 TP concentration from the EAA with BMPs implemented	119 ppb
Three-year flow-weighted mean TP concentration	106 ppb

[1] The baseline period of record is October 1978–September 1988 in accordance with EFA requirements. Compliance under Rule 40E-63 bases compliance on the water year periods from May 1 to April 30 that fall within the October 1978–September 1988 range, that is, WY1980–WY1988.

The data for all calculated years are summarized in **Table 4-3**. This table presents observed and predicted (baseline period rainfall adjusted) TP data and annual rainfall and flow measurements. Additionally, the TP values presented are attributable only to the EAA basin (farms, cities, and industry) and do not represent the cumulative TP being discharged to the Everglades from all sources.

Table 4-3. WY1980–WY2006 EAA basin TP measurements and calculations.

Water Year	Observed TP Load (mt)	Predicted TP Load[1] (mt)	% TP Load Reduction[2]	Annual Rain (in)	Annual Flow (kac-ft)	Baseline Period	Pre-BMP Period	LOK SWIM BMPs	Evrglds Rule BMPs
1980	167	154	-9%	53.50	1,162				
1981	85	98	13%	35.05	550				
1982	234	255	8%	46.65	781				
1983	473	462	-2%	64.35	1,965				
1984	188	212	11%	49.83	980				
1985	229	180	-27%	39.70	824				
1986	197	240	18%	51.15	1,059				
1987	291	261	-12%	51.97	1,286				
1988	140	128	-9%	43.43	701				
1989	183	274	33%	39.68	750				
1990	121	120	-1%	40.14	552				
1991	180	219	17%	50.37	707				
1992	106	179	41%	47.61	908				
1993	318	572	44%	61.69	1,639				
1994	132	160	17%	50.54	952				
1995	268	388	31%	67.01	1,878				
1996	162	503	68%	56.86	1,336	First Compliance Year			
1997	122	240	49%	52.02	996				
1998	161	244	34%	56.12	1,276				
1999	128	249	49%	43.42	833				
2000	193	425	55%	57.51	1,311				
2001	52	195	73%	37.28	667				
2002	101	227	55%	49.14	1,071				
2003	81	125	35%	45.55	992				
2004	82	229	64%	46.76	961				
2005	182	444	59%	50.98	1,190				
2006	153	270	44%	50.08	1,035				

Note: Dashed vertical line indicates the period for which BMPs were not fully implemented (WY1992–WY1995).

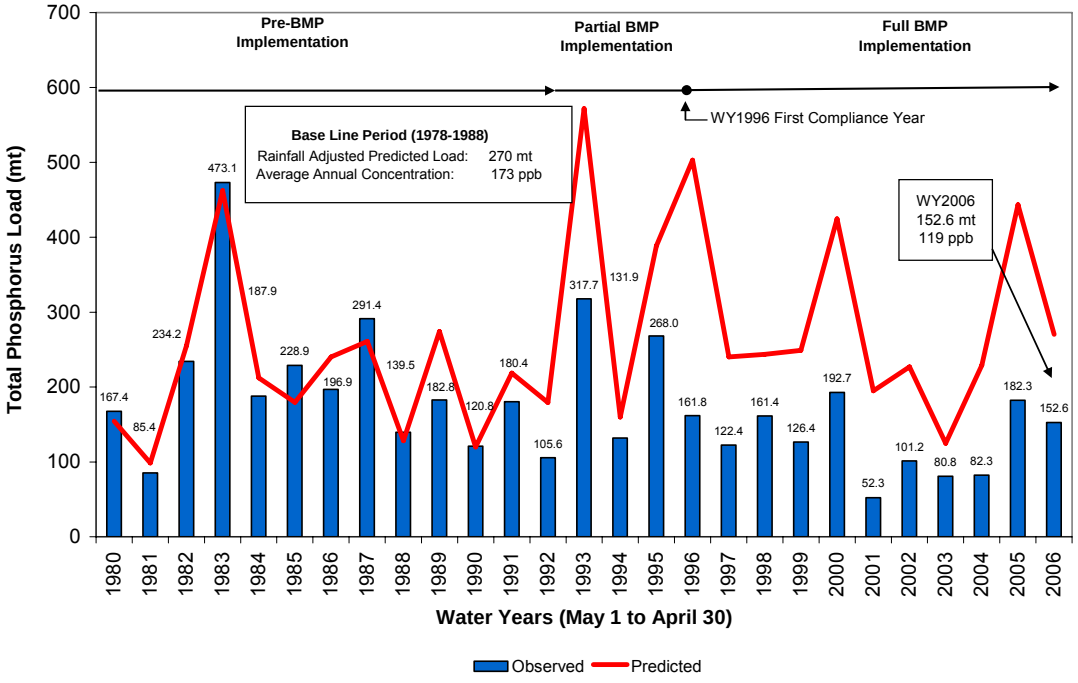
[1] "Predicted TP Load" represents the base period load, adjusted for rainfall variability.

[2] "%TP Load Reduction" values for WY1980–WY1988 represent the compliance model calibration period.

Figures 4-3 through **4-6** represent the TP data graphically. In **Figure 4-3**, each bar represents the actual (observed) annual TP tonnage from the EAA basin in each water year, and the solid line represents the annual TP tonnage predicted (rainfall adjusted) by the rule-mandated model. The annual percent reduction of TP is calculated as the relative difference between the actual (bar) EAA basin TP load and the predicted (line) base period TP load (adjusted for rainfall). As this chart indicates, the EAA basin has consistently outperformed its mandated goal. As shown in **Figure 4-4**, if the EAA basin had met the minimum requirement of a 25 percent reduction in TP load for the 11 years that the program has been fully implemented, 787 metric tons (mt) would have been prevented from leaving the basin. However, because the basin has exceeded the minimum requirements, 1,734 mt of TP were prevented from leaving the EAA basin as runoff. This comparison is based on what would have been expected under the same hydrologic conditions during the pre-BMP baseline period.

The EAA basin percent TP load reduction trend is presented in **Figure 4-5**. The solid line shows the three-year trend of percent load reduction. The "♦" symbol represents the annual measurements. An upward trend in the solid line in **Figure 4-5** denotes a reduction in loads, that is, an improvement in the water quality of EAA basin runoff discharges.

TP concentrations are calculated in addition to load; however, concentration levels are not evaluated to determine EAA basin compliance. The annual concentrations and three-year trends presented are true "annual flow-weighted" values calculated by dividing the total annual cumulative TP load by the total annual cumulative flow. **Figure 4-6** shows the TP concentration trends for the EAA discharges.



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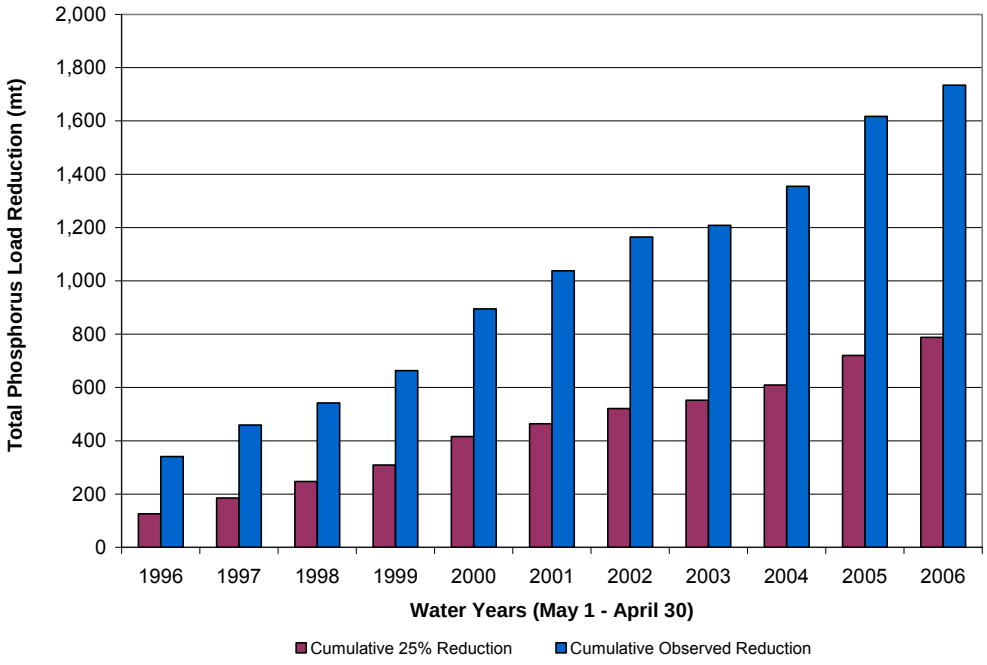
266 **Figure 4-3.** EAA basin TP loads observed (measured) and predicted (calculated).



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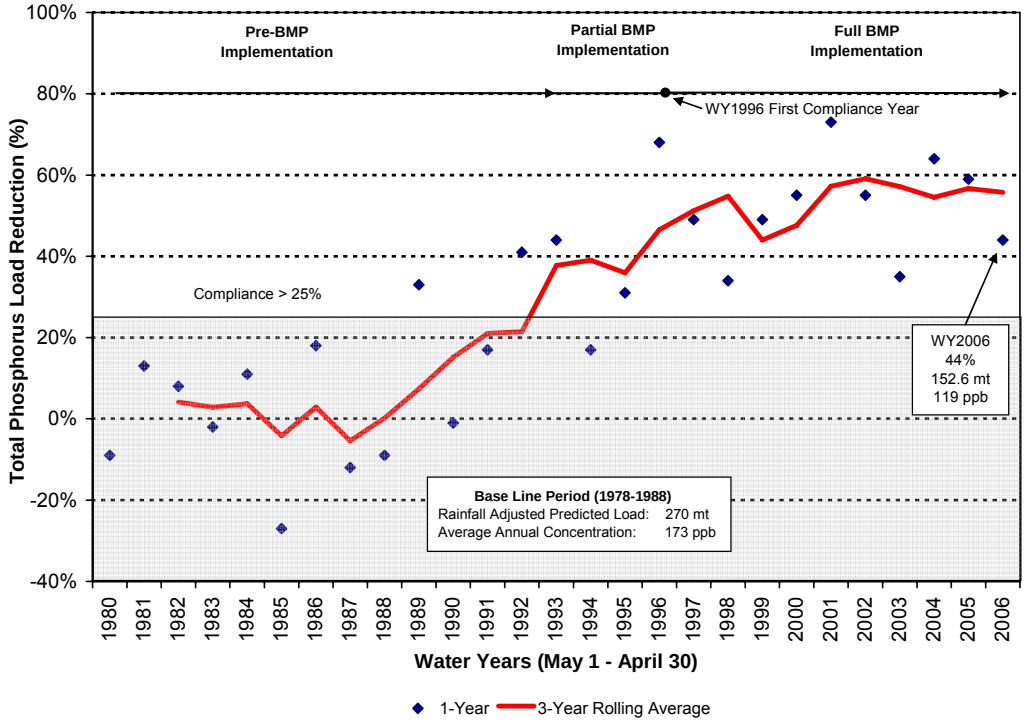
268 **Figure 4-4.** EAA basin cumulative percent TP load reduction trend.



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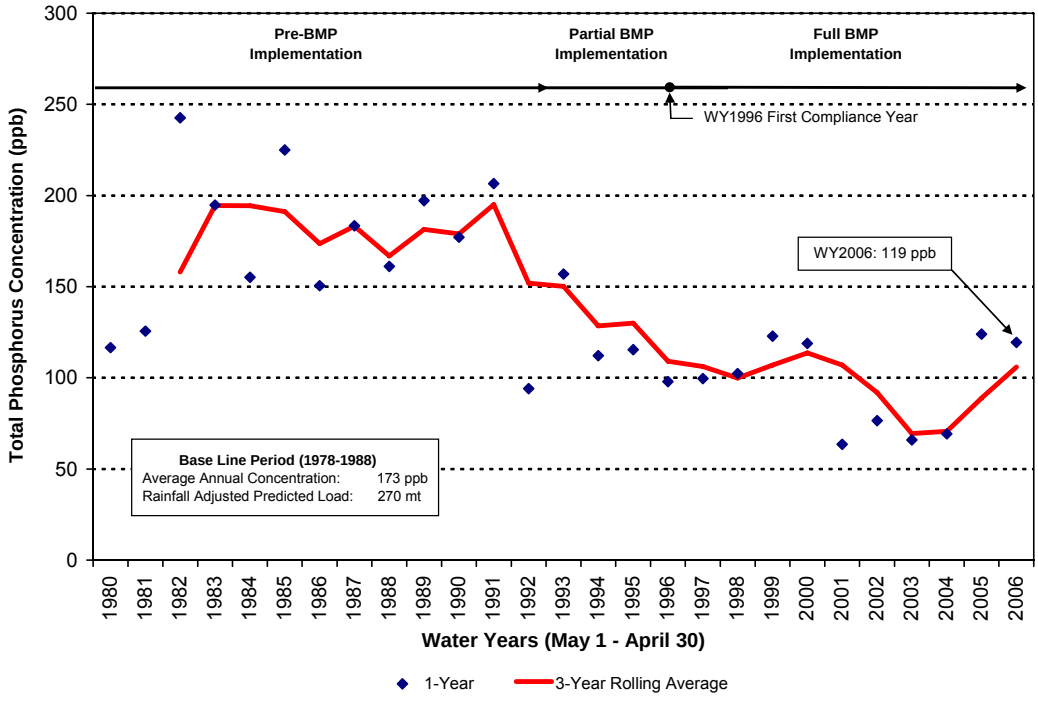
270 **Figure 4-5.** EAA basin percent TP load reduction trend.



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272 **Figure 4-6.** EAA basin TP FWM concentration trend.

EAA Basin-Level Phosphorus Measurements and Calculations

Since the implementation of BMPs required by the Everglades Regulatory Program, TP loads from the surface water runoff attributable to the lands within the EAA basin have been evaluated on an annual basis taking into account changes brought about from lands converting to STAs, inflow sources from external basins, and the addition of new water control structures. To interpret phosphorus measurements taken at inflow and outflow water control structures defining the boundary of the EAA basin, it is important to recognize that water leaving the EAA basin through these structures is a combination of EAA farm and urban-generated runoff and water passing through the EAA basin canals from external basins. This "pass through" water includes discharges from Lake Okeechobee and 298 District diversion areas. The diversion areas, shown in **Figure 4-2,** include the South Florida Conservancy District (SFCD), South Shore Drainage District (SSDD), East Beach Water Control District (EBWCD), East Shore Water Control District (ESWCD), and Closter Farms. The runoff from lands within the diversion areas enter the EAA through four pump stations. During WY2005, three diversion pump stations were operating and discharging runoff from EBWCD (pump station EBPS3), the combined area of ESWCD and Closter Farms (pump station ESPS2), and SSDD (pump station SSDDMC) into the EAA basin. During WY2006, the last remaining diversion pump station serving SFCD (pump station SFCD5E) was completed and began operating August 1, 2005.

Depending on the inflow source and the entry point into the EAA basin, water quality within the basin can be influenced, although the extent of the influence is generally difficult to interpret. Therefore, separate accounting of TP loads from various sources is required to develop conclusions about TP loads originating from lands (or sub-basins) within the overall EAA basin. The TP loads in runoff from the sub-basin lands are conveyed primarily to STAs by the West Palm Beach Canal (WPB) (S5A sub-basin), the Hillsboro Canal (HILLS) (S6 sub-basin and a portion of the S2 sub-basin), the North New River Canal (NNRC) (S7 sub-basin and remaining portion of S2 sub-basin), and the Miami Canal (S8 and S3 sub-basins). The accounting of tributary sources and flow configurations to the Everglades is complex, and the reported TP loads attributed to the farms, cities, and industries within the EAA basin should not be confused with the total load being delivered to the Everglades.

The EAA basin-level compliance determination is based on monitoring at various inflow and outflow points defining the boundary of the sub-basins (S5A, S2/S6, S2/S7, and S3/S8) in any given water year and the conveyance canals serving those. The number of structures defining the boundary of the S3/S8 sub-basin during WY2006 (**Table 4-4**) was reduced compared to the WY2005 monitoring points as a result of construction activities associated with the completion of the STA-3/4 diversion/bypass structures and the re-routing of the STA-5 outflow canal. Due to these changes in boundary conditions, a reduction in the number of representative monitoring locations occurred and adjustments were made to the compliance determination methods in accordance with Rule 40E-63.

Historically, the S-7 and S-8 structures defined the southern boundary of the EAA basin for determining compliance with mandated TP load reduction requirements. During the previous water year (WY2005), the southern boundary of the EAA basin shifted upstream on both the Miami and NNRC. In WY2005, for the Miami Canal, the boundary at structure S-8 was replaced with upstream structures G-372 (STA-3/4 inflow) and G-373 (diversion/bypass). For the NNRC, S-7 was replaced with G-370 (STA-3/4 inflow) and G-371 (diversion/bypass). The new southern boundary at these structures, along with structures S-6 and S-5A, constituted the main outflow points for the entire year during WY2006.

Based on the new boundary conditions, summaries of flows and TP loads for each sub-basin, as identified in **Table 4-4**, are presented in **Table 4-5a**. These summaries generally describe the mass balance of inflows and outflows from the EAA sub-basins. The observed runoff TP load and runoff volume from each sub-basin, summing up to a total observed EAA basin runoff TP load of 152.5 mt and runoff volume of 1,034.5 thousand acre feet (kac-ft), is noted in **Table 4-5a**. More detailed WY2006 information on the annual load, flow, and TP flow-weighted mean (FWM) concentration at each of the individual inflow and outflow structures for each sub-basin in **Table 4-4,** along with TP data collection statistics and the current quality level of flow information at each structure, can be found in Appendix 4-1.

Table 4-5b presents a summary of the inflow and outflow TP concentrations for WY2006, which contrasts the concentrations of incoming flows from Lake Okeechobee with the total outflow concentrations from each sub-basin. The TP concentrations at the Lake Okeechobee inflow points (S-351, S-352, S-354) to the EAA sub-basins continue to show steadily increasing trends, with WY2006 data ranging between 209 parts per billion (ppb) and 294 ppb. This increasing trend in lake inflow TP concentrations to the EAA, is often cited as cause for concern in maintaining the actual performance level of BMPs reducing TP loads because the lake is a major source of irrigation water. An investigation of this relationship will be conducted during WY2007 to ascertain the impact of the lake inflows on EAA basin phosphorus levels.

While the accounting of flows and TP loads associated with EAA basin runoff and from other sources flowing into and out of the EAA basin is complicated, it is possible to determine the contributions from each of these sources by reviewing the total observed load at the basin outflow structure. For instance, during WY2006, the Miami Canal conveyed EAA basin runoff, Lake Okeechobee “pass through” flows, C-139 basin runoff, and runoff from two diversion area basins (SFCD and SSDD) to the STA-3/4 inflow structure (G-372). Therefore, G-372 received multiple sources of water of varying amounts (flow and TP load) which contributed to the total observed flow and TP load.

It is not the intent of this chapter to quantify or report how flows and TP loads from the various sources are allocated, or apportioned, to the various sub-basin outflow points. However, this information is useful in knowing how much water from sources external to the EAA basin (Lake Okeechobee and diversion areas), in addition to EAA basin runoff, is routed for treatment in or to bypass an STA because of capacity constraints in any given water year. Therefore, this type of detailed information is reported in other chapters of this volume, specifically Chapter 3C and Chapter 5, which provide a comprehensive picture of flow and TP loads (and the source) being discharged to the EPA and on STA performance, respectively.

353 **Table 4-4.** EAA sub-basin inflow and outflow monitoring points during WY2006.
354

EAA Sub-Basin (Canal)	Structure/Site	Inflow	Outflow	Effective Dates
S5A (WPB Canal)	S-5A (S-5A Complex)		●	†
	S-5AW (S-5A Complex)	●	●	†
	S-352	●	●	†
	EBPS3	●		†
S2/S6 (HILLS Canal)	S-6		●	†
	G-328		●	†
	S-2 (S-2 Complex)		●	†
	S-351 (S-2 Complex)	●		†
	ESPS2	●		†
S2/S7 (NNR Canal)	G-370		●	†
	G-371		●	start 2/1/06
	S-2 & S-351 (see above)	●	●	†
S3/S8 (MIA Canal)	G-372		●	†
	G-373		●	start 6/15/06
	G-373BC*		●	start 6/1/05 end 7/21/05
	S-3 (S-3 Complex)		●	†
	S-354 (S-3 Complex)	●		†
	SSDDMC	●		†
	SFCD5E	●		start 8/1/05
	G-136	●		†
	G-344A**	●		end 7/22/05
	G-344B**	●		end 7/22/05
	G-344C**	●		end 7/22/05
	G-344D**	●		end 7/22/05
	G-349B**		●	end 7/22/05
	G-350B**		●	end 7/22/05
	G-507**		●	end 7/22/05
	G-410**		●	end 7/22/05

355
356 † On the EAA model boundary for the entire water year.
357 * G-373BC represents the flow and load passing through the emergency bypass canal
358 located adjacent to the construction of G-373. Bypass event occurred between June 1,
359 2005, and July 21, 2005.
360 ** On July 22, 2005, the STA-5 conveyance canal was rerouted south of G-373 bringing it
361 outside the EAA model boundary. After that date the EAA model no longer tracks loads
362 and flows from the STA-5 structures and G-410.

Table 4-5a. EAA sub-basin flows and TP loads by source for WY2006.

S5A Sub-Basin	Load (mt)		Flow (kac-ft)	
Source	Inflow	Outflow	Inflow	Outflow
EAA	N/A	44.53*	N/A	180.16*
Lake	29.06	3.54	80.18	13.68
EBWCD	8.73	8.73	14.58	14.58
Total	**37.79**	**56.80**	**94.76**	**208.42**

S2/S6 Sub-Basin	Load (mt)		Flow (kac-ft)	
Source	Inflow	Outflow	Inflow	Outflow
EAA	N/A	35.85*	N/A	267.51*
Lake	23.16	2.22	69.71	6.98
ESWCD & Closter	6.87	6.87	26.80	26.80
Total	**30.03**	**44.94**	**96.51**	**301.29**

S2/S7 Sub-Basin	Load (mt)		Flow (kac-ft)	
Source	Inflow	Outflow	Inflow	Outflow
EAA	N/A	32.04*	N/A	235.83*
Lake	43.32	9.59	130.35	28.01
Total	**43.32**	**41.63**	**130.35**	**263.84**

S3/S8 Sub-Basin	Load (mt)		Flow (kac-ft)	
Source	Inflow	Outflow	Inflow	Outflow
EAA	N/A	40.18*	N/A	350.99*
Lake	33.77	11.94	130.78	44.47
C-139	9.68	9.68	30.59	30.59
SSDD	2.43	2.43	14.72	14.72
SFCD	3.35	3.35	17.08	17.08
STA5	7.19	7.19	60.96	60.96
Total	**56.42**	**74.77**	**254.13**	**518.81**

Note: The total loads and flows leaving the sub-basins represent pass through volumes as well as volumes originating within the basin. With the exception of lake inflows, it is assumed that 100 percent of all other inflow sources to the EAA sub-basins pass through the main EAA conveyance canals directly to the outlet of each sub-basin. These assumptions are mandated in the model developed under Rule 40E-63 for determining EAA basin phosphorus load reductions.

* Represents each sub-basin's portion of the total EAA basin TP load and volume from runoff.

N/A Not Applicable

Table 4-5b. EAA sub-basin inflow and outflow FWM TP concentration for WY2006.

EAA Sub-Basin	Lake Inflow FWM Concentration (ppb)	Total Outflow FWM Concentration (ppb)
S5A	294	221
S2/S6	269	121
S2/S7	269	128
S2/S8	209	117

EAA Basin-Level Annual Variations

The EAA basin as a whole experiences many variations throughout the water year from both a hydrologic and a water quality standpoint. Compared on a water-year-by-water-year basis since the full implementation of BMPs in WY1996, Lake Okeechobee discharges to the EAA typically have had higher TP concentrations than EAA basin discharges. Within the EAA basin, variations in rainfall and lake inflows also exhibit significant variances from east to west, making a complex picture more difficult to interpret when considering individual phosphorus sources within the basin.

Rainfall variation in both spatial and temporal distribution influence runoff patterns throughout the basin. For instance, a basinwide average rainfall amount of 52 inches occurring in two separate water years can produce markedly different runoff volumes and TP loads. The impact of spatial and temporal variation on runoff is the basis for the rainfall adjustments that are applied to pre-BMP baseline predicted loads. **Figure 4-7a** depicts the annual variation of total rainfall occurring within each of the four major sub-basin groups (averaged rainfall from sites within the sub-basin) compared to the total rainfall for the entire EAA basin (averaged rainfall from all sites) since WY1996. The figure shows that the S5A sub-basin generally receives higher amounts of rainfall than the other sub-basins. During WY2006, the S3/S8 sub-basin received the highest amounts of rainfall, and the S5A sub-basin received the lowest. **Figure 4-7b** depicts the variation of WY2006 sub-basin monthly rainfall compared to the total monthly rainfall for the EAA basin. Chapter 2 of this volume provides more in depth explanations of the hydrologic events that occurred throughout the District during WY2006.

Since WY1996, runoff volumes between the sub-basins have typically shown an evenly distributed and narrower range of variation when based on the percent contribution (typically 20 to 30 percent each) of each to the total EAA basin runoff volume (**Figure 4-8a)**. However, with runoff TP loads among the sub-basins, a wider range of variation is seen (**Figure 4-8b**). Typically, when the S5A sub-basin receives more rainfall than the other sub-basins, the runoff TP load from S5A is correspondingly higher and amounts to 30 to 50 percent of the EAA basin total annual runoff TP load.

During WY2006 there were three factors that most likely explain lower TP loads from S5A sub-basin runoff. One factor was rainfall, since the S5A sub-basin received the lowest amount of rainfall in comparison to other sub-basins. The second factor was a significantly lower amount of lake inflow into the sub-basin, as more lake water was shifted to other inflow conveyance points that move water to STA-3/4. The last factor would be a sub-division of the S5A sub-basin that occurred during the year when a new divide structure (G-341) was completed on the Ocean Canal near the northwest corner of STA-1W. The divide structure effectively re-distributed farm runoff within the S5A sub-basin into STA-2 from approximately 27,550 acres that would have flowed into STA-1W.

The figures presented are used to make general observations of variations seen in rainfall, runoff volumes and runoff TP loads from year to year. The EAA basin as a system is influenced by many factors that contribute to higher or lower TP loads in runoff and the distribution of the runoff loads throughout the basin. Determining the cause and effect relationships is important in order to understand how the current level of BMP performance can be maintained. These relationships will be the subject of an evaluation as a WY2007 Long-Term Plan activity.

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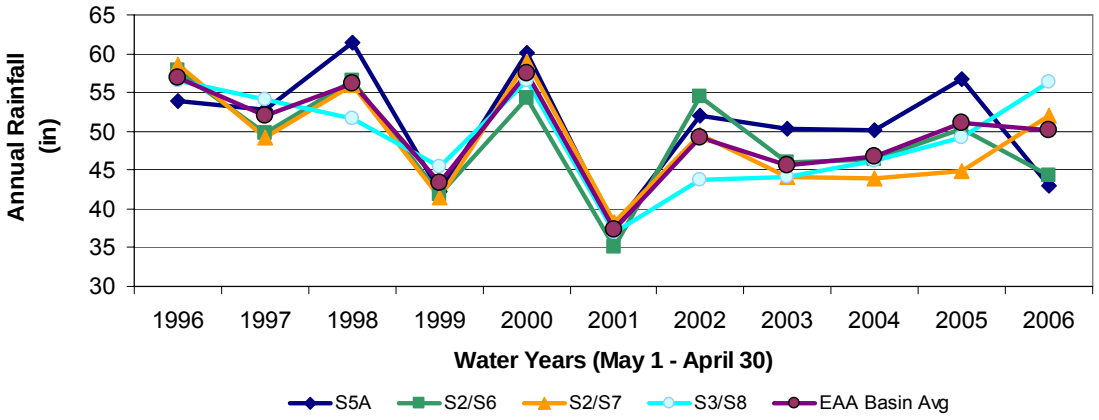
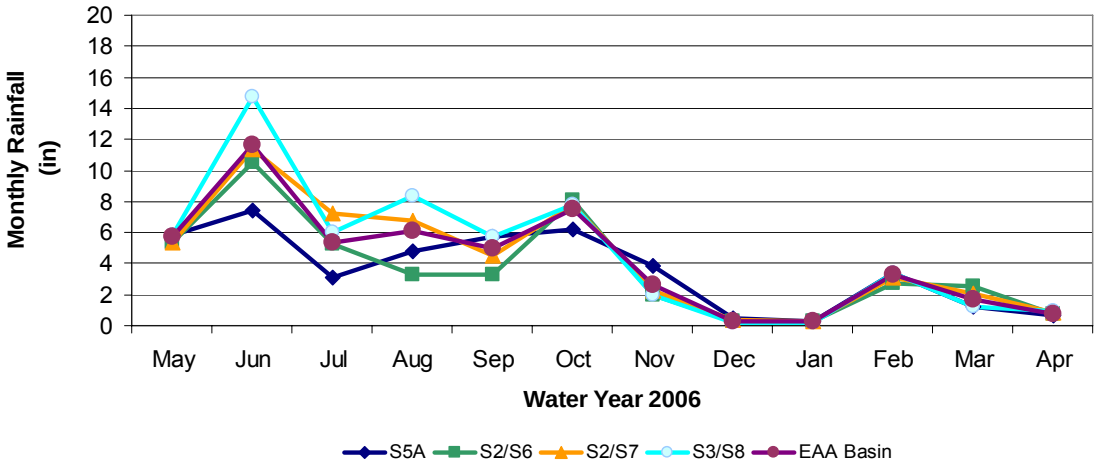


421

422 **Figure 4-7a.** WY1996–WY2006 EAA sub-basin annual rainfall distribution trend.

423



424

425 **Figure 4-7b.** WY2006 EAA sub-basin monthly rainfall distribution trend.

426

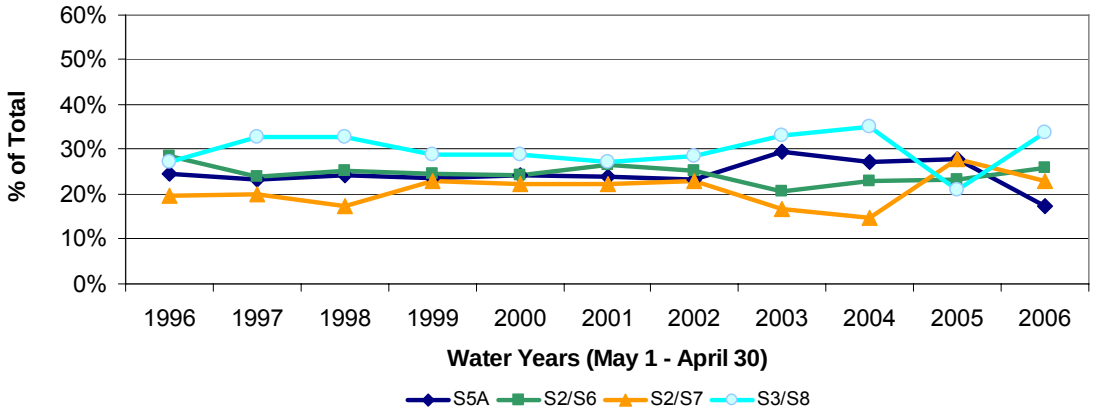


Figure 4-8a. WY1996–WY2006 EAA sub-basin annual runoff volume percent "relative" contribution trend of basin total.

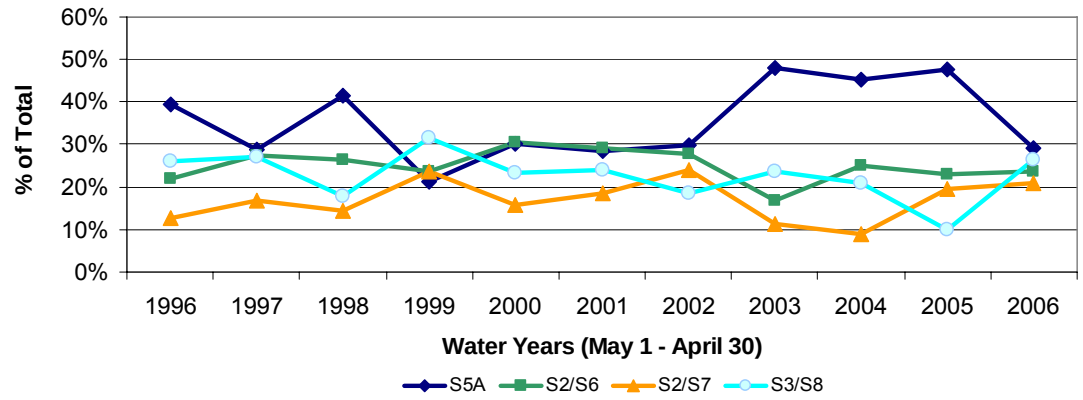


Figure 4-8b. WY1996–WY2006 EAA sub-basin annual TP load percent "relative" contribution trend of basin total.

Source Control Strategy

The source control strategy for the EAA basin primarily relies on an EFA-mandated regulatory program for BMP implementation for which compliance determinations began in WY1996. Rule 40E-63 states that the use of Everglades Works of the District (EWOD) within the EAA basin requires a permit for a BMP plan for each crop within each sub-basin or farm. As in prior years, permittees in the EAA basin implemented a 25-point BMP plan during WY2006. Plans are comprehensive, generally consisting of nutrient management, water management, and sediment controls. Changes to the BMP Plans require District approval. Additionally, the source control strategy in the EAA basin includes supplemental Long-Term Plan projects for the purpose of optimizing the already successful regulatory program.

Update on Source Control Activities for the EAA Basin

Summary of WY2006 Activities

During WY2006, the District implemented the on-going EFA-mandated regulatory BMP program and made progress on the Long-Term Plan supplemental projects as detailed in Chapter 3 of the *2006 South Florida Environmental Report – Volume I.* Following is an update on these activities:

1. **BMP Regulatory Program:** At the end of WY2006, there were 486,381 acres under 32 EWOD permits in the EAA. There were 15,692 acres removed from EWOD permits due to construction of CERP and Acceler8 projects during the year. Post-permit compliance activities continued in these farm basins through on-site BMP verifications. BMP verifications were prioritized based on farm location, water quality history, size, and date of previous verification.
2. **BMP Replacement Water:** The EFA mandated hydroperiod restoration and the replacement of anticipated reductions in EAA basin runoff volume to the EPA as a result of BMP implementation. An original assumption was made that BMP water retention in the EAA would equal 20 percent of the total base flow that was discharged from the EAA from 1979 through 1988. The District has applied a model adopted by Rule 40E-63 on an annual basis (1995–2005) to calculate the quantity of replacement water that the District must release to the EPA to meet these requirements. With 11 years of BMP implementation and extensive data collected during this time period, evidence suggests that post-BMP hydrology has not significantly changed in comparison to pre-BMP hydrology and, therefore, the anticipated reduction in runoff volume has not been realized. For WY2006, the District continued to use the current rule adopted model; however, the methodology is under review.
3. **BMP Research:** In addition to the Everglades Regulatory Program, the EFA and Rule 40E-63 require EAA landowners, through the Everglades Agricultural Area – Everglades Protection District (EAA-EPD), to sponsor a program of BMP research, testing, and implementation to monitor the efficacy of established BMPs in improving water quality in the EPA. These activities are conducted under a Master Permit for BMP Research, Testing and Implementation in accordance with Part III of Rule 40E-63. The Master Permit is issued to the EAA-EPD and research is conducted by the University of Florida Institute of Food and Agricultural Sciences (IFAS) in Belle Glade.

In March 2005, the District renewed the permit for an additional five-year period with modifications to the prior scope of work, as requested by the permittee. Based on final reports submitted by IFAS for BMP research on specific conductance and farm scale research on BMP effectiveness, the District approved the removal of these projects from the scope. Other prior Master Permit requirements remained unchanged. The proposed scope added statistical evaluation of the permittee-collected regulatory data and the farm scale research data to develop new farm scale projects, enhancement of the BMP education and extension services by including a one-on-one consultation program on priority farms, and completing the final report for the particulate phosphorus demonstration farm project.

The EAA BMPs for Reducing Particulate Phosphorus Transport – Final Report, was completed in June 2005 (Daroub, 2005). The report summarized the $3 million, four-year research project which was cost-shared by the EAA-EPD (75 percent) and the FDEP (25 percent). Main project objectives were to (1) demonstrate the long-term viability of on-farm BMPs, including mitigating total phosphorus concentration and load spikes; (2) identify phosphorus sources, content, and cycling characteristics of floating aquatic plants, sediments, and suspended particulate matter and how they can be used to reduce phosphorus loading; and (3) demonstrate water management systems leading to greater levels of particulate matter detention. The report discussed that there are a myriad of factors that can affect the magnitude of phosphorus concentrations leaving a particular farm on an event wise and long-term basis. The report indicated that the BMP potential to reduce phosphorus concentrations is not equal among farms, for reasons that are sometimes beyond the control of the farmer. The "lowest reasonable achievable" concentration varied between 50 ppb and 150 ppb at the sites used for the project. The report recommended focusing on understanding phosphorus dynamics within the District canal system, the STAs and the water conservation areas on the basis that "there are simply too many factors related to phosphorus cycling in the aquatic systems, phosphorus transport issues, inherent background phosphorus levels, Lake Okeechobee concentrations and loads, and human interaction effects that would occlude or negate the effort toward achieving further farm-level phosphorus load reductions" (Daroub, 2005). A copy of this report and others prepared by the University of Florida can be obtained at the following web site: http://erec.ifas.ufl.edu/WQ/WQ-ReportSum.htm.

Three written quarterly reports were submitted by IFAS to the District documenting progress on the implementation of the scope of work mandated by the permit. Highlights documented in these reports include the following:

- Update of training modules used for BMP training workshops: Explanation of Rule 40E-63; Wise use of Ametryn and Atrazine in the EAA; BMP Table Overview, calibrated Soil Testing and Plant Use Tissue Analysis; Fertilizer Spill prevention and Nutrient Application Control, Rainfall Detention; Sediment and Particulate Phosphorus Control; and Particulate Phosphorus Research Update. Eight BMP training workshops were offered during WY2005 and registered 176 participants.
- Development of Extension Materials for BMP implementation, which are published online at http://edis.ifas.ufl.edu.
- Completion of one-on-one BMP consultation program completed for 44 farms, representing 63 percent of the farm basin acreage, in the S5A sub-basin as of April 15, 2006.

- Creation of the dataset for the statistical analysis has been completed and investigative hypotheses have been discussed with grower representatives.

On July 14, 2006, the University of Florida IFAS submitted its 2005 Annual Report and presentation at the EAA-EPD Annual Landowners Meeting (Daroub, 2006). A brief description of the IFAS activities anticipated for 2007 is as follows:

- Submittal of a detailed plan describing the statistical analyses to be conducted. Upon District review and approval, the statistical analysis will be initiated with completion expected in 2007.
- Identification of gaps in existing BMP research and recommendation of future research projects to enhance BMP effectiveness, based on the results of the statistical evaluation.
- Completion of the one-on-one consultation program in the S5A sub-basin, and initiation of the consultations in the S6 sub-basin.
- Expansion of outreach efforts to the Hispanic workforce by translating training modules into Spanish for additional workshops.

4. **298 Diversion Projects:** The EFA mandates as an element of the Everglades Restoration Program the completion of system modifications described in the ECP for the diversion of Lake Okeechobee discharges from the East Beach Water Control District (EBWCD), SSDD, SFCD, East Shore Water Control District (ESWCD), and Closter Farms[1]. The Everglades Protection Project Conceptual Design Document (Burns & McDonnell, 1994) defined the primary objective of the system modifications to be the reduction of total phosphorus loads historically discharged to Lake Okeechobee from those areas by no less than 80 percent. The system modifications were constructed using a phased approach between 2001 and 2005, diverting discharges south through the EAA.

   These modifications have the potential to impact the EAA basin's water quality; however, STAs were specifically designed to receive the additional load. As defined in the Conceptual Design Document, STA design is also based on the assumption that BMPs consistent with Rule 40E-63 and resulting in a not less than 25 percent reduction in average TP loads would be implemented in the diversion basins. SSDD and SFCD discharges are directed to the Miami Canal, reaching STA-3/4; ESWCD and Closter Farms to the Hillsboro Canal and STA-2; and EBWCD to the West Palm Beach Canal, reaching STA-1W.

   To date all diversion projects have been completed. Environmental Resource Permits (ERPs) were issued consistent with Conceptual Design Document goals, and BMP plans are being implemented in accordance with EWOD permits. ERP permits require submittal of annual reports documenting diversion ratios on a calendar-year basis. These reports indicate that, except for infrequent high-rain conditions (e.g., hurricanes), or pump maintenance or testing at Lake Okeechobee structures, discharges from EBWCD, SSDD, and ESWCD only occur through the Everglades diversion structures, thus, the diversion ratios are being met in these basins. Discharges at the SFCD diversion structure began on August 1, 2005; however, no data are available to complete a diversion report.

[1] a.k.a. Agricultural Lease Number 3420 or 715 farms

5. **EAA Exploratory Statistical Analysis (Long-Term Plan Project "EAA Basins - Source Controls," FY2004–FY2006):** In response to Long-Term Plan requirements to identify additional opportunities to optimize the BMP program and address public inquiries, an exploratory statistical analysis on existing permittee-collected regulatory data was completed in 2006 (Stanley Consultants and ZFI Engineering and Construction, Inc., 2006). The primary objective of the analysis was to identify high-level relationships and "screening tools" for BMP Program optimization opportunities based on the available permit level data.

   Analysis findings support expectations associated with EAA farm discharges that had previously been assumed and not based on actual review of data. The specific causes behind the TP load and concentration relationships presented in the analysis, however, could not be identified with certainty because of the lack of information on the many factors affecting the characteristics of farm discharges. The analysis report concluded that the use of more refined datasets is necessary and that suggestions for more refined analyses be provided to IFAS for consideration in their BMP research efforts and data analysis (using BMP research data collected by IFAS at the farm level) or for additional field investigation. The analysis report is available on the Long-Term Plan web site at http://www.sfwmd.gov/org/erd/longtermplan/documents.shtml.

Anticipated Activities for WY2007

1. **BMP Regulatory Program:** An additional 1,555 acres is expected to be permitted under the EWOD program through addition of lands in the L-8 basin. An estimated 20,823 acres is expected to be removed from EWOD permits due to construction of CERP and Acceler8 projects. BMP verifications will continue using a prioritized list based on farm location, water quality history, size, and date of previous verification.

2. **BMP Replacement Water:** It is expected that the methodology will be updated through rule development to more accurately represent planned changes to the conveyance system from ongoing Accelerat8/CERP projects in the EAA basin and ensure that the significance of pre- and post-BMP hydrology is accounted for in determining runoff reductions.

3. **298 Diversion Projects:** Currently, diversion areas are treated as pass-through waters that are directed to the STAs for treatment but are not evaluated for compliance with the 25 percent reduction in TP loading. The calculations to determine the load from the EAA boundary subject to the baseline period definition are adjusted to eliminate the diversion loads entering into the EAA sub-basins. The EFA provides the basis for this procedure and states that the data utilized to calculate the actual loads attributable to the EAA shall be adjusted to eliminate the effect of any load and flow that were not included in the 1979–1988 baseline period [§373.4592(6)(a)(2)]. Prior to 2001, the diversion areas discharged exclusively to Lake Okeechobee and, therefore, were not part of the baseline period. Defining a method for evaluating the effectiveness of BMPs in these recent tributaries (diversion areas) to the EPA will be initiated to meet the requirements in the EFA [§373.4592(4)(f)(4)].

4. **EAA TP Load Reduction Compliance Model:** The methodology will be reviewed to ascertain if proposed alternatives in the EAA Regional Feasibility Study, concerning conveyance system changes for ongoing Acceler8/CERP projects in the EAA basin, would require changes to the method for tracking inflow and outflows from the EAA basin and determining how observed runoff is calculated. It is anticipated that the selected alternative will be unveiled in early 2007 by the Acceler8 team. If the system changes are significant and the current methodology in Rule 40E-63 can not accommodate the configuration

changes, a model modification process will be initiated which would require revisions to the rule through Chapter 120 of the Florida Statutes (F.S.) rule development.

5. **EAA Basin Data Evaluation (Long-Term Plan Project "EAA Basins - Source Controls," FY2004–FY2006):** As stated in Section 5.1 Source Controls (BMPs) (Project Bc81) of the Long-Term Plan, activities directed at maintaining performance levels can be categorized into characterization, identification, and implementation efforts. The District has initiated an investigation to characterize EAA basin discharges and processes tributary to those discharges in more detail. In particular, the extent to which Lake Okeechobee inflows impact the EAA sub-basins and the relatedness of those inflows to the maintenance of current levels of BMP performance in the EAA will be evaluated. In recent years, the District has received public inquiries on why differences in TP concentrations and loads exist in surface waters throughout the EAA and the effects of the load coming into the EAA from Lake Okeechobee in the form of irrigation waters and pass through waters.

   The primary objective of this project is to develop an understanding of the relationship between Lake Okeechobee inflows, EAA basin runoff, and downstream points of entry into STA's and the factors that govern those relationships. It is anticipated that the analysis will be accomplished through a basin level data evaluation (flows, load, concentrations, and any other relevant data) for trends, changes, and significance that will help define the relationships. This project will complement another Long-Term Plan project, Lake Okeechobee Long-Term Trends. The study focuses on improving the District's understanding of the relationship between Lake Okeechobee nutrient status and operation (depth regulation, choice of outflow point) on phosphorus loads discharged to the STAs. Additional information on this project can be obtained in Chapter 8 of this volume, which describes various Long-Term Plan initiatives.

C-139 BASIN UPDATE

In contrast to the EAA basin where an annual 25 percent reduction in TP loads is required, the goal of the source control program in the C-139 basin is to maintain TP loads at or below historic levels. The EFA mandates that landowners within the C-139 basin not collectively exceed the annual average TP load observed during the pre-BMP baseline period. The rule allows for the option of a permit-level discharge monitoring plan to be considered as a secondary compliance methodology should the C-139 basin be determined to be out of compliance. None of the permits issued to date include the optional discharge monitoring plan; therefore, only C-139 basin level data is reported herein. The C-139 basin and the representative monitoring locations during WY2006 for determining compliance with TP load reduction is shown in **Figure 4-9**.

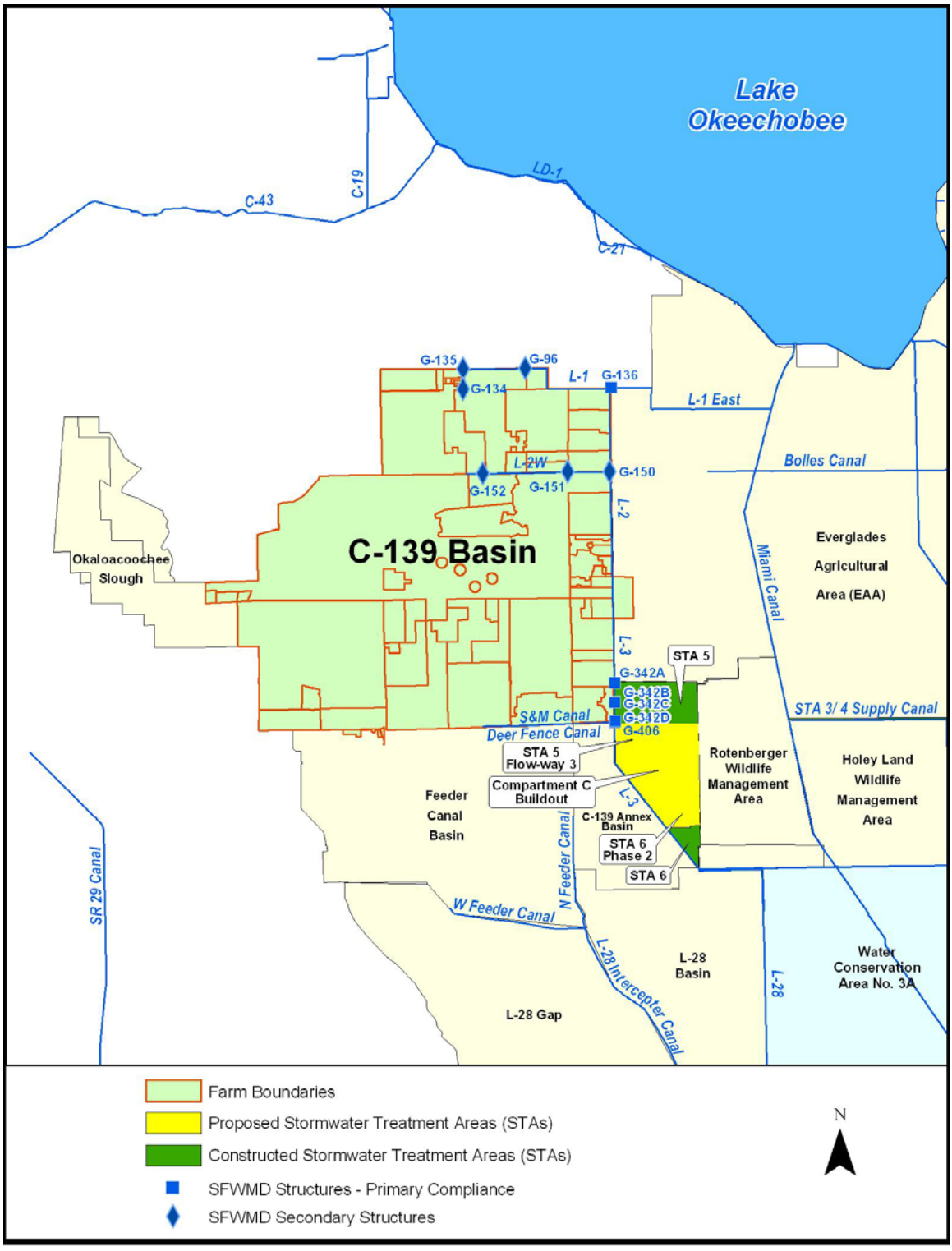


Figure 4-9. The C-139 basin and primary compliance water control structures within the ECP boundary during WY2006.

Water Year 2006 Phosphorus Results for the C-139 Basin

WY2006 is the fourth year for compliance determination in the C-139 basin. As in the previous three years, the C-139 basin has been found to be out of compliance with the mandated TP load limitations. The District has notified all permittees that the C-139 basin was determined to be out of compliance in accordance with Rule 40E-63. BMP implementation levels and compliance actions between WY2003 (initial compliance year) and WY2006 are summarized in **Table 4-6**. The District will initiate a rulemaking effort pursuant to Chapter 120, F.S., to ensure that the objectives of the EFA are met.

Table 4-6. WY2003–WY2006 C-139 basin BMP implementation summary.

Compliance Water Year (WY)	BMP Level	Compliance with rule	Compliance Action
WY2003	Initial Implementation of Level I – 15 points	No	Go to Level II *Full Implementation in November 2003
WY2004	Implement Level II – 15 points with site verification visits	No	Go to Level III *Full Implementation in November 2004
WY2005	Implement Level III – 25 points with site verification visits	No	Go to Level IV *Full Implementation in November 2005
WY2006	Implement Level IV – 35 points with site verification visits	No	Initiate Rulemaking

Note: A water year (WY) is defined as May 1—April 30.

* Since a majority of flow and load occurs during the wet season from May to October, full implementation of the next level of BMP effort (typically starting in November of the water year following an out of compliance water year), would not be expected to yield any improvements until the next wet season.

During WY2006, C-139 basin permittees were required to implement Level IV BMPs. However full Level IV implementation, occurring in November 2005 (which is after the wet season when most runoff had occurred), was not a factor in improving runoff loads from the basin. During the WY2006 wet season, the level of impact from BMPs would therefore be associated with Level III.

A preliminary review of rainfall, runoff volumes, and water quality data has been conducted to identify potential causes for the results despite the increased level of BMP implementation and the positive trends observed during WY2005. The observed runoff volume (333 kac-ft) and TP load (106.9 mt) discharged during WY2006 were the second highest amounts observed from the basin since WY1980. However, the basin received 53.79 inches of rainfall during WY2006 which is only slightly greater than the long-term annual average of 50.81 inches (WY1980–WY2006) for the C-139 basin. A general summary in both graphical and tabular format is presented, followed by a review of WY2006 basin data with associated contrasting against WY2005 data.

675 **Table 4-7** provides a summary of the results of the WY2006 compliance calculation for total
676 observed and predicted TP loads where the observed load is the pre-BMP baseline period load
677 adjusted for differences in rainfall. Compliance is determined by comparing the observed TP load
678 for the current water year to the predicted load from the pre-BMP baseline period. Using the
679 rainfall adjustment, target loads are calculated based on the 50th percentile confidence level value
680 for predicted loads under the year's rainfall conditions, while limit loads are calculated based on
681 the 90th percentile. The alternate confidence levels accommodate for possible statistical error in
682 the model. Limit loads provide for a higher confidence level so that a single year exceedance
683 verifies noncompliance while the target loads are evaluated only when exceeded on three
684 consecutive years.

685 **Table 4-7.** Results of WY2006 C-139 basin TP compliance calculations.

WY2006 C-139 TP Load	
Estimated TP Target load (adjusted for WY2006 rainfall amount and distribution)	34.6 mt
Estimated TP Limit load (target load at the upper 90 percent confidence interval)	62.0 mt
Actual WY2006 TP load from the C-139 with partial BMP implementation (Level IV)	106.9 mt

686

WY2006 C-139 TP Concentration	
Actual annual average C-139 TP concentration prior to BMP implementation (WY1980–WY1988)[1]	227 ppb
Actual WY2006 TP concentration from the C-139 with minimum BMP implementation at Level IV	260 ppb
Three-year flow-weighted mean TP concentration	249 ppb

687 [1] The baseline period of record is October 1978–September 1988 in accordance with EFA
688 requirements. Compliance under Rule 40E-63 bases compliance on the water year periods from
689 May 1 to April 30 that fall within the October 1978–September 1988 range, that is, WY1980–
690 WY1988.

691

692 The observed, predicted target, and predicted limit TP data for the C-139 basin, along with
693 the annual rainfall and flow measurements are presented in **Table 4-8**. This table presents data for
694 all calculated years (pre-compliance and initial compliance). The TP values presented in
695 **Table 4-8** are attributable only to the C-139 basin and do not represent the cumulative TP being
696 discharged to the Everglades after treatment through STA-5.

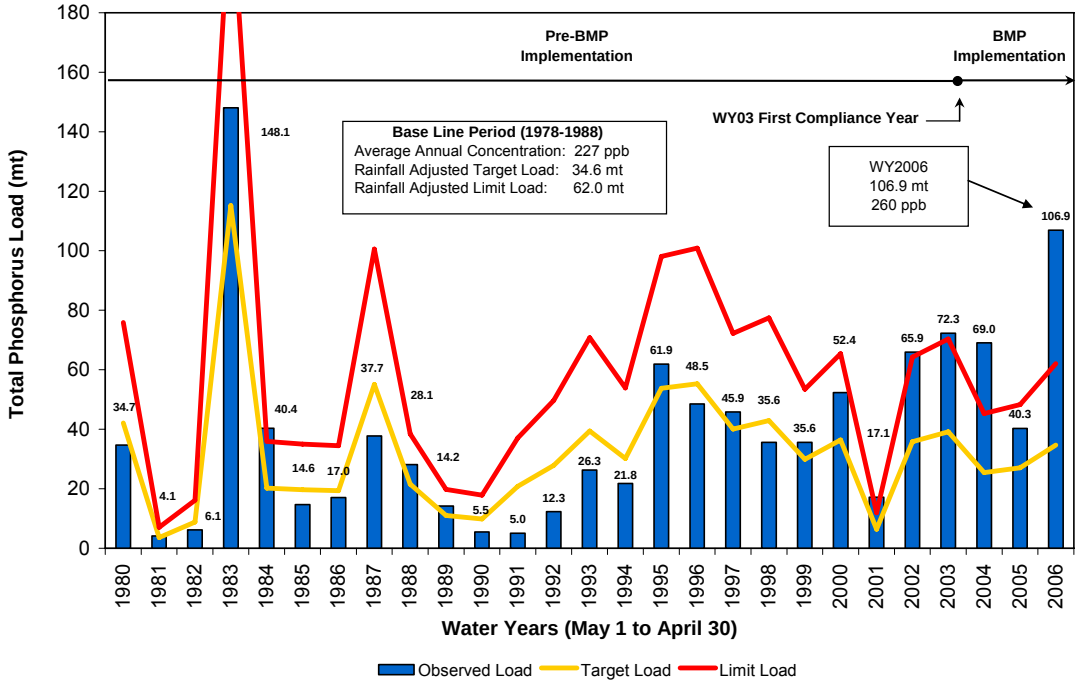
697 **Figures 4-10** and **4-11** shows the data graphically. In **Figure 4-10**, each bar represents the
698 actual (observed) annual TP tonnage from the C-139 basin in each water year, and the lines
699 represent the annual TP target and limit loads predicted after being adjusted for rainfall, by the
700 rule mandated method. **Figure 4-11** shows the annual FWM TP concentration of discharge from
701 the C-139 basin shown by both individual yearly concentration values and the three-year rolling
702 average FWM concentration. However, compliance in the C-139 basin is determined by TP load
703 discharged from the basin, not concentration.

704 **Table 4-8.** WY1980 through WY2006 C-139 basin TP measurements and
705 calculations.

Water Year[2]	Observed TP Load (mt)	Predicted Target TP Load[1] (mt)	Predicted Limit TP Load[1] (mt)	Annual Rain (in)	Annual Flow (kac-ft)	Baseline Period	Pre-BMP Period
1980	34.7	42.1	76	56.39	172		
1981	4.1	3.6	7	31.06	51		
1982	6.1	8.8	16	38.61	44		
1983	148.1	115.2	222	71.98	344		
1984	40.4	20.2	36	47.19	156		
1985	14.6	19.6	35	46.88	63		
1986	17.0	19.3	34	46.71	110		
1987	37.7	55.0	101	60.19	149		
1988	28.2	21.6	38	47.96	94		
1989	14.2	11.0	20	40.69	73		
1990	5.5	9.8	18	39.62	46		
1991	5.0	20.8	37	47.53	45		
1992	12.3	27.9	50	51.04	100		
1993	26.3	39.4	71	55.49	137		
1994	21.8	30.2	54	52.03	136		
1995	61.9	53.8	98	59.85	272		
1996	48.5	55.2	101	60.24	236		
1997	45.9	40.1	72	55.74	165		
1998	35.6	42.9	77	56.65	170		
1999	35.6	29.9	53	51.92	136		
2000	52.4	36.4	65	54.46	202		
2001	17.1	6.4	12	35.70	56		
2002	65.9	35.8	64	54.23	200		
2003	77.3	39.1	70	55.40	224		
2004	69.0	25.4	45.3	49.90	204		
2005	40.3	27.1	48.3	50.68	168		
2006	106.9	34.6	62.0	53.79	333		

706 [1] Using the rainfall adjustment, target loads are calculated based on the 50th percentile value for
707 predicted loads under the year's rainfall conditions, while limit loads are calculated based on
708 the 90th percentile.

709 [2] First year of compliance measurement is WY2003.



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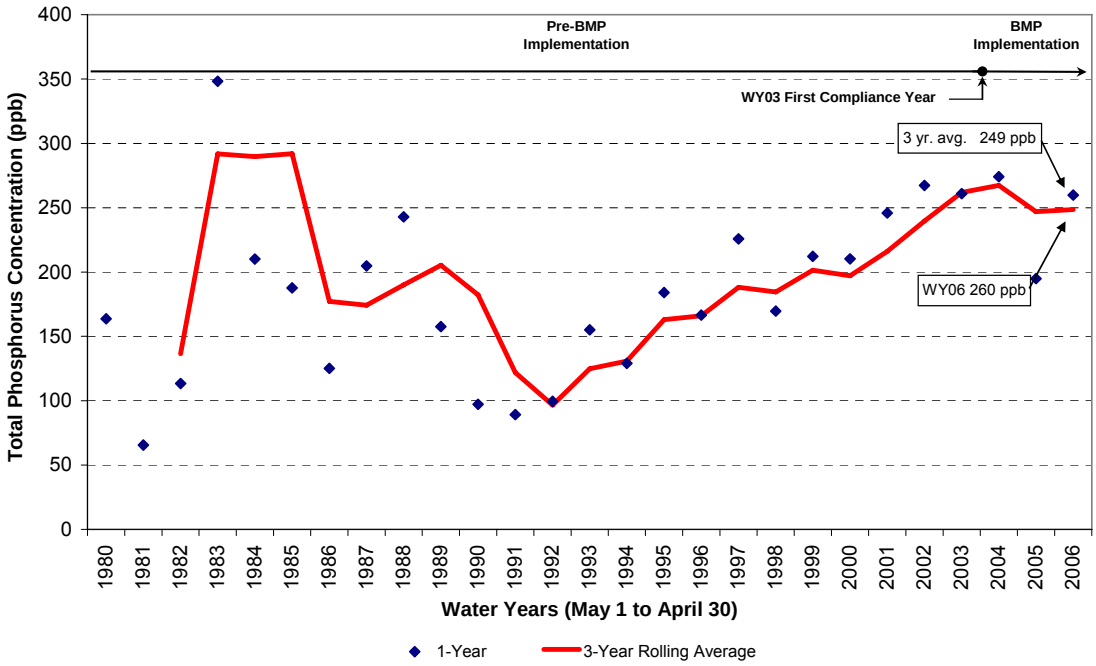
711 **Figure 4-10.** C-139 basin TP loads observed (measured) and predicted (calculated).



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713 **Figure 4-11.** C-139 basin FWM TP concentration trend.

C139 Basin-Level Phosphorus Measurements and Calculations

As in the EAA basin, the District is required to collect monitoring data from the C-139 basin to determine compliance with the TP load limitations. The TP load ultimately discharging to the Everglades is not the same as the TP loads leaving the outflow structures from the C-139 basin because some discharges are directed into other water bodies. The outfall structures accounting for the loads in the C-139 basin compliance determination include G-136 discharging to the L-1 canal; G-342A, G-342B, G-342C, and G-342D discharging into STA-5; and G-406 discharging into the L-3 canal when STA-5 cannot receive additional discharges. The overall flows, TP loads, and FWMCs at the six primary basin outflow structures are summarized in **Table 4-9**.

Table 4-9. C-139 basin flows, TP loads, and FWM concentrations by source for WY2006.

C-139 to EAA Source	TP Load (mt)	Flow (kac-ft)	FWM (ppb)	% of Total Load	% of Total Flow
G-136 Total [1]	**9.7**	**30.6**	**257**	**9.1%**	**9.2%**

C-139 to STA-5 Source	TP Load (mt)	Flow (kac-ft)	FWM (ppb)	% of Total Load	% of Total Flow
G-342A	12.7	60.3	170	11.9%	18.1%
G-342B	15.5	69.3	181	14.5%	20.8%
G-342C	15.6	54.8	231	14.6%	16.5%
G-342D	9.3	32.1	234	8.7%	9.6%
G-342A-D Total	**53.1**	**216.5**	**199**	**49.7%**	**65.0%**

C-139 to WCA-3A Source	TP Load (mt)	Flow (kac-ft)	FWM (ppb)	% of Total Load	% of Total Flow
G-406 Total[2]	**44.1**	**86.1**	**415**	**41.3%**	**25.8%**

[1] G-136 discharges runoff from C-139 basin lands that are tributary to the L-1 canal. Conveyance of runoff through G-136 into the Miami Canal for eventual treatment in STA-3/4 is due to flood control necessities in the L-1 canal and capacity limitations in sending the runoff to the south through the L-2 and L-3 canals for treatment in STA-5.

[2] G-406 is the STA-5 bypass structure. It is used when STA-5 capacity constraints preclude C-139 basin runoff from being sent for treatment. Bypassed discharge through G-406 flows to the south and into the northwest section of Water Conservation Area 3A (WCA-3A).

During WY2006, the basin received 53.79 inches of rainfall, discharged 333.2 kac-ft of runoff volume and 106.9 mt of TP load with a FWM concentration of 260 ppb. The highest concentrations during the year were observed at the G-406 structure with an annual FWM concentration of 415 ppb. The runoff flows through G-406 accounted for only 26 percent of the total basin outflow. However, the TP load represented 41 percent of the total basin runoff load because of the higher concentrations occurring at G-406. Although STA-5 optimization projects were ongoing throughout the water year, all inflow structures (G-342A-D) were operating during the wet season from May through October 2005. However, capacity constraints in STA-5, as in previous years, continues to hamper the ability of the STA to treat all runoff from the basin. An

update on optimization projects conducted in STA-5 during WY2006 is provided in Chapter 5 of this volume. Additionally, planning and engineering design are underway for expansion of STA-5 and STA-6 to add more treatment area for C-139 basin runoff. Information on the expansion plans can be found in Chapter 8 of this volume.

Like the EAA basin, the C-139 basin as a whole receives many variations throughout the water year from both a hydrologic and a water quality standpoint. Rainfall distribution, both spatially and temporally, influences runoff patterns from the basin to a significant degree. Higher amounts of rainfall occurring in the early months of the wet season appear to generate greater runoff amounts than if the same rainfall amounts were distributed over more months. This result may be indicative of the current capabilities of the drainage and water management system within the basin to detain and dispose of excess rainfall amounts. Additionally, rainfall that occurs in the western parts of the basin which is primarily native and improved pasture will take longer to translate into runoff, as opposed to a faster runoff response in areas adjacent to the main drainage canals (L-2, L-3, and Deerfence canals) where more land is in row crop, citrus, and sugar cane production.

The general trend of annual rainfall (departure from average) is depicted in **Figure 4-12** for WY1980–WY2006. The trend indicates that the period is broken into two distinct periods of dry rainfall conditions from WY1980 to WY1992, followed by wet rainfall conditions from WY1993 to WY2006. **Figure 4-13** shows how the amount of rainfall in the C-139 basin contrasts with the amount of rainfall that translates into excess runoff. During the earlier dry period, excess runoff generally ranged from 10 to 20 percent of total rainfall, with the exception of 1983, which was 34 percent. During the latter wet period from WY1993 to WY2005, excess runoff ranged from 20 to 30 percent of total rainfall, with the exception of 2001 which was 11 percent and a drought year. During this wet period (including WY2006), the annual rainfall amount has averaged to 54.65 inches (excluding WY2001). In terms of rainfall, WY2006 with 53.79 inches was not very different from the previous 14 years. However, a significantly higher amount of excess runoff occurred in comparison to the previous 14 years with 44 percent of rainfall becoming excess runoff. The highest TP load in the basin (148 mt) occurred in WY1983 accompanied with 71.98 inches of rainfall and nearly the same runoff volume (344 kac-ft) as compared to WY2006. This relationship of much higher runoff with relatively little change in annual rainfall amounts since WY1993 tends to indicate that land use intensification or other basin changes may have accelerated within the basin.

Land use intensification may be one component during WY2006 that contributed to more excess runoff and, thus, higher TP loads but likely does not explain the full picture of what transpired in the basin that caused higher amounts of runoff and TP loads. The amount and timing of rainfall also appears to have had a significant impact on the basin. **Figure 4-14** shows the daily rainfall, runoff volume, and TP load occurring during WY2006 compared to WY2005. Two periods stand out during WY2006 which may explain the amount of excess runoff and TP load emanating from the basin. These are explained as follows.

Like the EAA basin, the C-139 experienced heavy amounts of rainfall early on in the wet season during April 2005. This antecedent condition prior to the start of WY2006 potentially led to a wetter than usual May than in previous years. Additionally, the basin also received heavy rainfall amounts in June 2005 due to continuous storm activity that crossed the basin during the month. Runoff volumes and TP loads were highest during the months of May, June, and July 2006.

In contrast to the EAA basin during WY2006 and with previous years in the C-139 basin, the C-139 was in the direct path of Hurricane Wilma, which occurred on October 24, 2005. Besides increased rainfall levels, associated runoff, and erosion, it is assumed that wind effects may have also significantly influenced observed TP loads from the basin. As reported by vegetable growers in the area, hurricane effects translated into strong winds, which affected recently planted crops for the fall-winter growing season. District visits to the basin following Hurricane Wilma documented that several planted parcels were severely impacted or did not survive; thus, lands laid fallow or crops were replanted. Plastic fabrics, used to cover vegetable beds preventing nutrient leaching and erosion, were shredded by the wind and blown away. Given that most significant nutrient application occurs at vegetable planting, Hurricane Wilma's impact due to timing and wind intensity may have indirectly resulted in nutrient and sediment losses from the destroyed crops as well as additional nutrient application to replant lost crops or compensate for losses. Concurrent with the effects to vegetable growers, low-laying lands such as cattle pasture areas were flooded possibly resulting in nutrients being flushed out under higher runoff conditions. Unavoidable weather hardships, such as Hurricane Wilma, may conceal the early successes that BMP implementation is having on the basin discharges. Additional time is necessary to evaluate the long-term trends of the new management practices and ultimately refine them.

The cumulative impacts of these two main events on basin runoff and TP loads from the basin are shown in **Figure 4-15**. The figure contrasts WY2006 with WY2005 and depicts the impact of starting out with a wetter than usual season on runoff and TP loads. The figures presented are used to make general observations of variations seen in rainfall, runoff volumes and runoff TP loads between the current and previous water years. The C-139 basin, like the EAA, is a complex system influenced by many factors making it sometimes difficult to explain cause and effect relationships that contribute to higher or lower TP loads in runoff from the basin. Determining these relationships is important though in order to understand how the current level of BMP performance can be improved. These relationships are the subject of a C-139 basin Phosphorus Water Quality and Hydrology Analysis that is being completed in phases during WY2006 and WY2007. Additionally, more monitoring is planned throughout the basin during WY2007 to aid in the District's understanding of the relationships.

An additional factor in gaining a better understanding of C-139 basin hydrology and relationships to water quality centers on the temporal distribution of rainfall during a water year. In contrast to the EAA basin compliance model which evaluates the monthly distribution of basin rainfall to predict the rainfall adjusted load during the baseline period, the C-139 basin model has no such adjustment. Therefore, a basin wide average rainfall of 52 inches occurring in two different water years will yield the same prediction of runoff TP load during the baseline period, irrespective of the distribution of the rainfall during the water year. The EAA basin model will yield differing predictions of runoff load for the same rainfall amount by accounting for distribution during the water year. This temporal distribution factor will be evaluated further during WY2007.

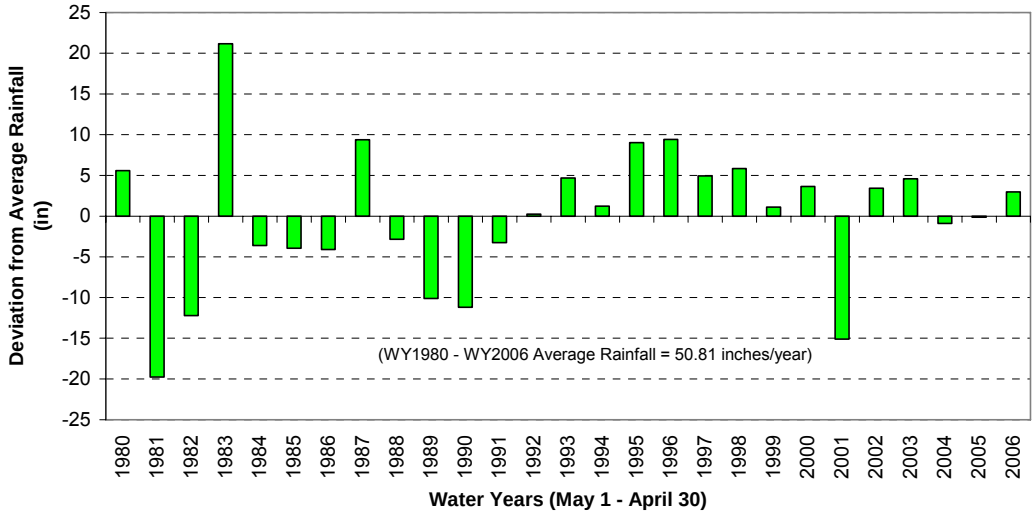


Figure 4-12. WY1980–WY2006 C-139 basin annual rainfall deviation from long-term average.

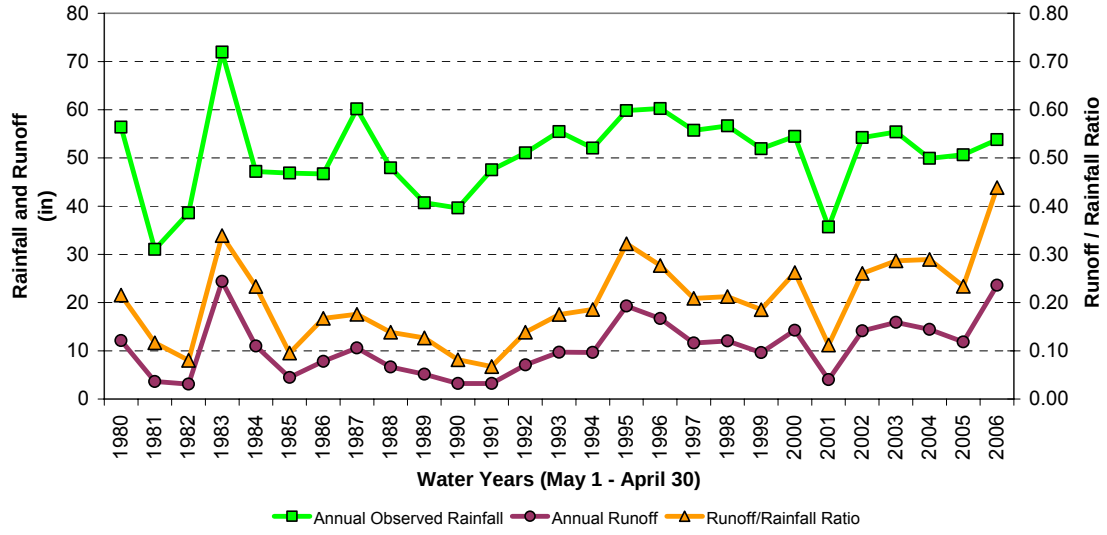
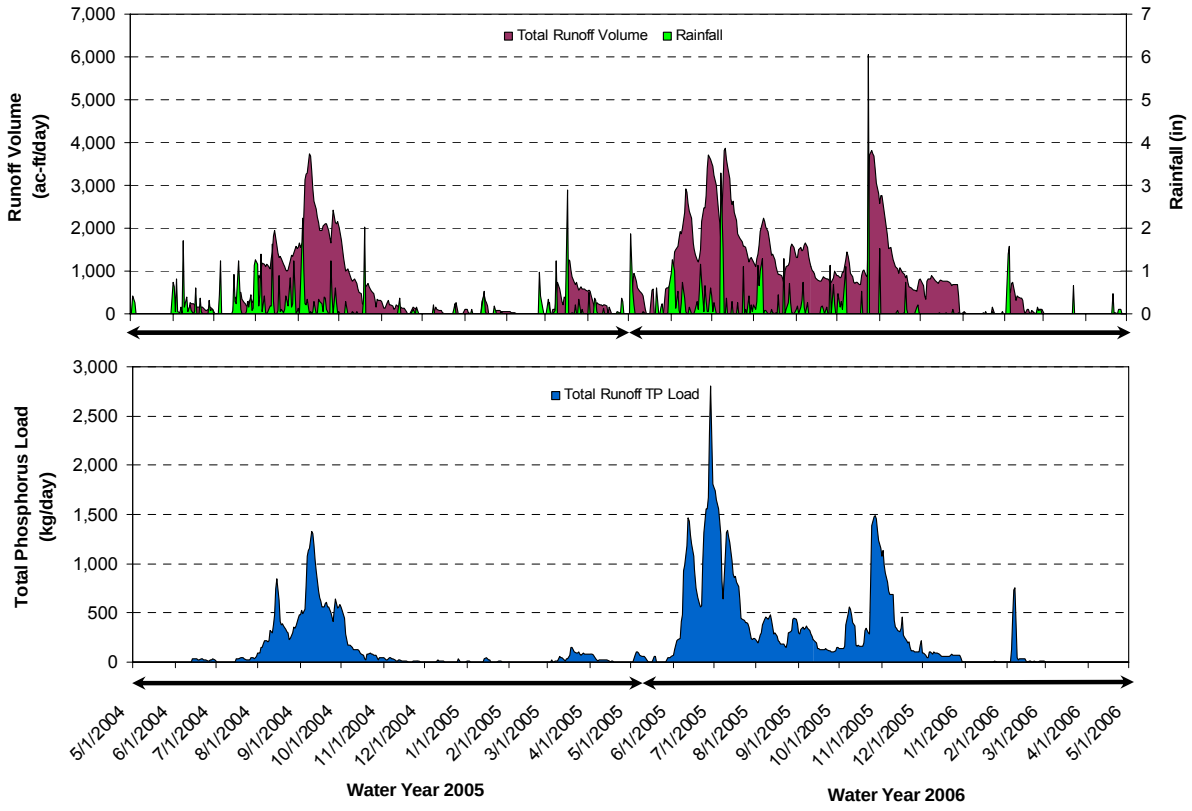
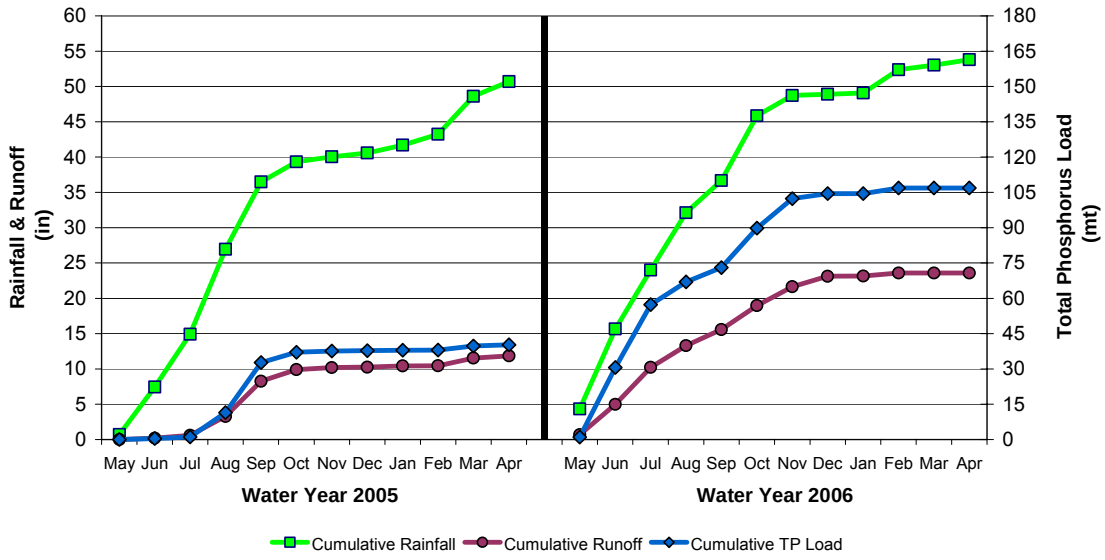


Figure 4-13. WY1980–WY2006 C-139 basin annual rainfall and runoff relationship.



836 **Figure 4-14**. WY2005 and WY2006 comparison of C-139 basin daily rainfall, runoff
837 (top), and TP load (bottom).



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839 **Figure 4-15.** WY2005 and WY2006 comparison of C-139 basin cumulative monthly
840 rainfall, runoff, and TP load.

Source Control Strategy

The source control strategy for the C-139 basin primarily relies on an EFA-mandated regulatory program with increasing levels of BMP implementation based on compliance status with the basin load limits. The first year of compliance determination was WY2003. Rule 40E-63 states that the use of EWOD within the C-139 basin requires a permit that approves a permittee-implemented BMP plan. Permittees in the C-139 basin implemented a 25-point BMP plan during the May–October 2005 period. Upon notification that the basin had not complied with TP load limits for WY2005, permittees were required to initiate implementation of a 35-point BMP plan by November 2005. Changes to the BMP plans require District approval. Additionally, the source control strategy in the C-139 basin includes supplemental Long-Term Plan projects to improve the existing regulatory program of BMPs.

Update on Source Control Activities in the C-139 Basin

Summary of WY2006 Activities

During WY2006, the District continued the comprehensive plan to strengthen the mandatory regulatory program with funding provided by the Long-Term Plan and state appropriation funds for the following C-139 basin source control initiatives:

1. **BMP Regulatory Program:** Mandatory BMP verification visits were initiated in November 2005 and are ongoing. At the 35-point BMP level, additional BMP verification visits are necessary for one-on-one outreach, verification, and refinement. In various cases, planned infrastructure improvements necessary for achieving the 35-point BMP level are not yet complete; thus, alternative BMP plans with similar equivalent requirements are being implemented. The District has observed a significant improvement in understanding and implementation of BMPs as the permit requirements have become more stringent; however, additional compliance verification and outreach are necessary to ensure uniform implementation.

2. **C-139 Basin Phosphorus Water Quality and Hydrology Analysis (Long-Term Plan Project "C-139 Basin - Source Controls," FY2006–FY2007):** Phase I of the C-139 Basin Phosphorus Water Quality and Hydrology Analysis was completed. The analysis (A.D.A. Engineering, Inc., 2006) describes the current basin hydrology and consolidates all available technical documentation. It was recognized that a thorough understanding of basin hydrology and water quality within the basin is essential for an effective source control program and for prioritizing resources within the program. The analysis defined 10 hydrologic sub-basins and identified four monitoring locations where flow and TP concentration could be measured to supplement the three monitoring locations for the C-139 basin monitoring network described in Item 3 below. The results of Phase I are summarized in Deliverable 5.4 – Phase 1 Report (February 2006) which can be accessed at the following web site: http://www.sfwmd.gov/org/erd/longtermplan/documents.shtml.

3. **C-139 Basin Monitoring Network Optimization (Long-Term Plan Project "C-139 Basin - Source Controls," FY2006–FY2009):** In an effort to improve the source control program, the District has identified areas where additional water quality data is necessary. Three TP concentration and flow monitoring stations have been installed within the basin to assist in characterizing discharges from the Deerfence and S&M canals, and transfers from the north side of the basin (L-1 canal) to the south (L-2 canal) at the G-150 structure.

Together with the water quality monitoring data at the inflow structures to STA-5 and diversions through G-406, these structures will dissect the contribution from the four major tributaries: Deerfence Canal, S&M Canal, L-2/L-3, and L-1 canals. Monitoring station data are reported on a weekly basis since May 2005 for G-150, and since February 2006 for the Deerfence and S&M stations.

4. **C-139 Basin Upstream Synoptic Monitoring:** As part of monitoring initiatives, the District began collecting water samples at 18 sites that represent upstream locations of basin regulatory compliance points. These sampling locations give "snapshots" of phosphorus concentrations throughout the watershed in the wet season (April 1–October 30). The samples are collected weekly if flowing. To date, weekly samples from August 1, 2005 through October 31, 2005, have been collected at the 18 sites. The sampling began again on April 1, 2006, and weekly samples will be collected through October 31, 2006. The parameters tested are TP, total dissolved phosphorus (represents total soluble phosphorus or TSP), and ortho-phosphorus (represents soluble reactive phosphorus or SRP). Analysis of these data is planned for 2007 under the C-139 Basin Phosphorus Transport and Cycling project described in the Anticipated Activities for WY2007 section.

5. **C-139 Basin Vegetable Production Demonstration Project (Long-Term Plan Project "C-139 Basin - Source Controls," FY2005–FY2008):** The C-139 Basin Vegetable Production Demonstration contract was initiated in August 2005. The goal of the project is to optimize phosphorus fertilization rates through soil testing specifically for C-139 basin soils. A soil test allows growers to accurately predict soil phosphorus availability and adjust fertilizer rates accordingly. When fertilizer is applied to a crop at rates greater than recommended, there may be no positive response by the crop and excess phosphorus may be lost through leaching or runoff. The three-year project is being conducted by the University of Florida IFAS Southwest Florida Research and Education Center in Immokalee and the IFAS Hendry County Cooperative Extension Service in LaBelle. Four demonstration sites were monitored during the 2006 winter-to-spring growing season.

6. **C-139 Basin Phosphorus Transport and Cycling (Long-Term Plan Project "C-139 Basin - Source Controls," FY2006–FY2007):** An exploratory investigation of phosphorus cycling and transport in the Deerfence and S&M canals was completed. The quantity and form of phosphorus in the surface water sediments under quiescent conditions in response to one storm flow event and phosphorus reflux from sediments were characterized at 11 locations. Based on the information collected, the S&M Canal appears to be a more significant source of phosphorus than the Deerfence Canal, and the phosphorus transported down both canals is primarily dissolved. Canal sediments were not found to be a significant source or sink of phosphorus. Preliminary recommendations were made with emphasis on verifying the findings through continued sampling in the Deerfence and S&M canals for TP, TSP, SRP, and flow. The results of this evaluation can be obtained in the C-139 Basin Deerfence and S&M Canals Phosphorus Transport and Cycling – Final Report (Community Watershed Fund, 2005).

7. **C-139 and Western Basins BMP Grant Program (Long-Term Plan Project "C-139 Basin - Source Controls," FY2004–FY2007):** An additional $500,000 was awarded by the District to C-139 and Western basins landowners through the C-139 and Western Basins Best Management Practices Grant Program during WY2006. This is in addition to funds allocated by partnering agencies, the Florida Department of Agriculture and Consumer Services (FDACS) ($230,000 in WY2006), and NRCS ($273,000) for cost-sharing of BMPs. The accumulated District contribution to the grant program since FY2002 has been $1,800,000 with approximately $1,250,000 allocated to projects in the C-139

basin alone. The local partner, Hendry Soil and Water Conservation District, continued tracking the progress of projects funded under this and previous award processes. In August 2005, the District initiated grab water quality sampling at the individual projects in an effort to identify water quality trends before and after BMP implementation. Preliminary data have been reviewed with individual grantees. However, a more robust dataset is required before an analysis can be made. Annual update reports, C-139 and Western Basins Best Management Practices Grant Program Report, which provide detailed descriptions of the grant program and projects funded since FY2002, can be found on the District's Everglades Regulation Publications web site.

Anticipated Activities for WY2007

1. **BMP Regulatory Program:** Level IV BMP verifications and outreach efforts will continue to ensure uniform implementation. A fourth out of compliance determination in WY2006 requires the initiation of rulemaking by the District to amend Rule 40E-63 to ensure that the objectives of the EFA [§373.4592(4)(f)5, F.S.] are met. Several farm-level infrastructure improvement projects necessary for achieving the 35-point BMP level will be completed.

2. **C-139 Basin Phosphorus Water Quality and Hydrology Analysis (Long-Term Plan Project "C-139 Basin - Source Controls," FY2006–FY2007):** A contract for implementing Phase II of the C-139 Basin Phosphorus Water Quality and Hydrology Analysis was executed in May 2006. Phase II will focus on developing a hydrologic and water quality model to analyze flows and phosphorus loads from the C-139 basin, and evaluating water quality improvement projects using this model. The regulatory, technical, and economical feasibility of selected projects will be analyzed. Finally, a modeling tool will be developed to evaluate alternative water quality improvement projects. The project is anticipated to be completed by June 2007.

3. **C-139 Basin Monitoring Network Optimization (Long-Term Plan Project "C-139 Basin - Source Controls," FY2006–FY2009):** Four additional monitoring locations are being installed within the C-139 basin based on the recommendations of the C-139 Basin Phosphorus Water Quality and Hydrology Analysis. These four monitoring stations will supplement the three that were installed during WY2006, resulting in a total of seven monitoring stations. They will serve to track discharge characteristics from the 10 sub-basins identified under Phase I of the C-139 Basin Phosphorus Water Quality and Hydrology Analysis. Completion of Phase II of the C-139 Basin Phosphorus Water Quality and Hydrology Analysis may lead to identification and installation of two additional monitoring locations, if needed.

4. **C-139 Basin Vegetable Production Demonstration Project (Long-Term Plan Project "C-139 Basin - Source Controls," FY2005–FY2008):** The C-139 Basin Vegetable Production Demonstration Project will continue, including presentation of 2006 results in an annual report and dissemination through an annual workshop with vegetable growers planned for August 29, 2006.

5. **C-139 Basin Phosphorus Transport and Cycling (Long-Term Plan Project "C-139 Basin - Source Controls," FY2006–FY2007):** The District has executed a contract to expand the preliminary evaluation of phosphorus sources, transport, and cycling that was conducted in WY2006. Water quality and flow data collected at the monitoring stations, grab samples obtained during wet seasons 2005 and 2006, and inflows to STA-5 will be evaluated for correlations between upstream water quality and the discharge points from the C-139 basin.

6. **C-139 and Western Basins BMP Grant Program (Long-Term Plan Project "C-139 Basin - Source Controls," FY2004–FY2006):** WY2007 is expected to be the final year for funding the existing BMP Grant Program. The District will continue monitoring progress and water quality of cost-shared projects under the program.

7. **Solicit Landowners Feedback:** The District will conduct workshops to solicit input from landowners and permittees, and provide updates on the results of projects and investigations described above. These workshops are essential for maintaining open channels of communication with landowners and other stakeholders and mining ideas on the most effective strategies for the basin. A workshop was conducted in June 2006, and a follow-up meeting to present WY2006 water quality results is scheduled for August 30, 2006.

FUTURE DIRECTION FOR THE ECP BASINS

Continued implementation of the BMP mandatory programs in the EAA and C-139 basins, and achievement of the required levels of performance in TP loading from these basins are necessary for the District to achieve the phosphorus criterion in the EPA and fulfill its obligations under the EFA and the federal Everglades Settlement Agreement. The EAA is meeting the required performance levels of the EFA and Rule 40E-63 and maintenance of those levels is critical to continued success; however, refinement of the mandated program and supplementary activities are needed in the C-139 basin to achieve the EFA required level of performance.

Planned activities for the EAA basin consist of continuing the current level of implementation as mandated in the Long-Term Plan, and improving the District's understanding of the relationships between Lake Okeechobee inflows, EAA basin runoff, and downstream points of entry into STAs along with the driving factors that govern those relationships. The District will continue to rely on the findings and recommendations made by the University of Florida IFAS for improving BMP effectiveness at the farm level though research and enhanced extension services.

As mandated by Rule 40E-63, rulemaking will be initiated for the C-139 basin. Although additional time is required for the BMP program and supplementary source control projects to affect TP loading to the levels required by the EFA and ECP performance, there is limited understanding of current conditions for developing a more effective program. There is a great need for technical information to assure that any modifications to the rule will be effective in the long-term. Current water quality monitoring initiatives and technical analyses in parallel with interactive landowner workshops and interdivision regulatory coordination are intended to fill the void. The District will continue to develop and build upon a knowledge base to assess the most effective and feasible strategies.

SOURCE CONTROLS IN THE NON-ECP BASINS

The EFA allows for a more flexible adaptive approach to water quality improvement in discharges for the non-ECP basins as compared to the ECP basins' mandatory BMP program. This is, in large part, based on the non-ECP basins having historically contributed approximately 12 percent of the total load discharging to the EPA compared to the 88 percent contribution by the ECP basins. Because of the relatively small TP contribution by the non-ECP basins, they were allowed to discharge directly to the EPA with source control programs initiated in WY1998 to address the quality of the basins' discharges.

Although there is not a load limit specifically mandated for these basins, the EFA requires implementation of schedules and strategies to ensure progress toward ultimately achieving established water quality standards for discharges to the EPA. This is accomplished through basin-specific Water Quality Improvement Plans (WQIPs) that include a combination of source controls (BMPs), diversion strategies, and capital improvement projects consistent with the Long-Term Plan's direction to rely on source controls and integration with CERP and other local construction projects. WQIPs have been developed for all non-ECP basins: C-11 West, NNRC, NSID, Feeder Canal, L-28, C-111, Village of Wellington's (VOW) ACME Improvement District, and Boynton Farms basins. The non-ECP basins and associated structures that discharge into the EPA are depicted in **Figure 4-16**. Detailed information regarding the background and development of the WQIP for each basin can be found in Chapter 3 of the 2006 SFER – Volume I.

The water quality in basin discharges is monitored to track the success of the source control activities in each basin. This chapter provides an update on the WY2006 phosphorus data and the source control activities for individual non-ECP basins.

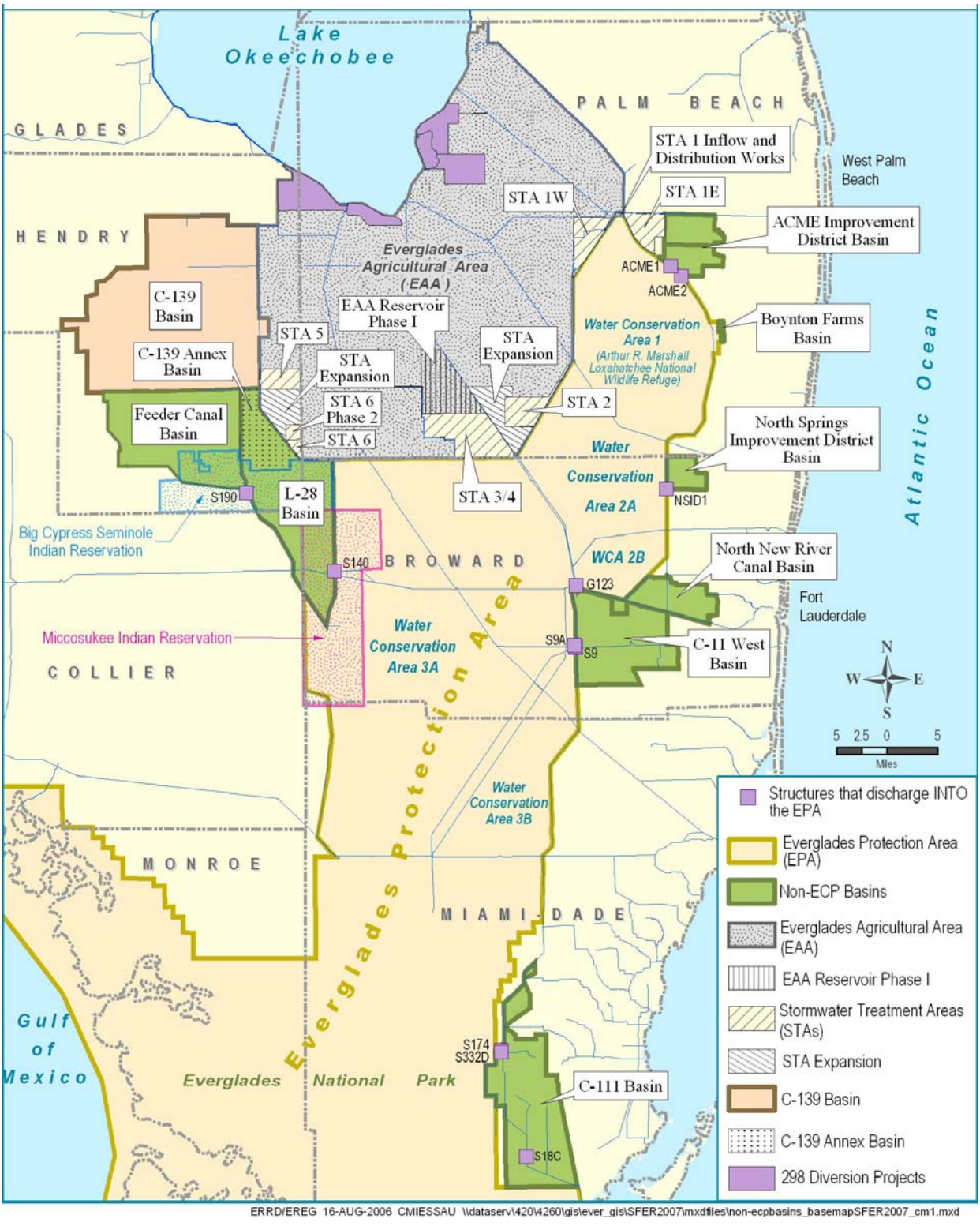

Figure 4-16. The non-ECP basins and primary compliance water control structures discharging to the EPA.

C-11 WEST BASIN UPDATE

WY2006 Phosphorus Results for C-11 West Basin

Of the three Broward County non-ECP basins, only the C-11 West basin regularly discharges to the EPA. Discharges from this basin are comprised of stormwater runoff and groundwater seepage returns through structures S-9 and S-9A into Water Conservation Area 3A (WCA-3A). The S-9A pump structure became operational in early 2003 and a divide structure (S-381) was completed in early 2005 (C-11 West Critical Project). This construction project changed the operation of the water management system by separating and returning seepage water with less phosphorus to WCA-3A, thereby decreasing the pumping frequency at the larger S-9 structure.

Figure 4-17a summarizes the daily rainfall and the monthly TP load, FWM TP concentration, rainfall, and flow volume in WY2006 for structures S-9 and S-9A. **Figure 4-17b** summarizes the annual TP load, TP concentration, rainfall, and flow volume for structures S-9 and S-9A from WY1998–WY2006. The S-9 and S-9A combined FWM TP concentration and TP load for WY2006 were 18 ppb and 4.26 mt, respectively.

A summary of the upstream water quality data used to identify high-phosphorus areas within the basin and a map of the C-11 West basin showing these data are available online in the Non-ECP Upstream Monitoring WY2006 report on the District's Everglades Regulation Publications web site.

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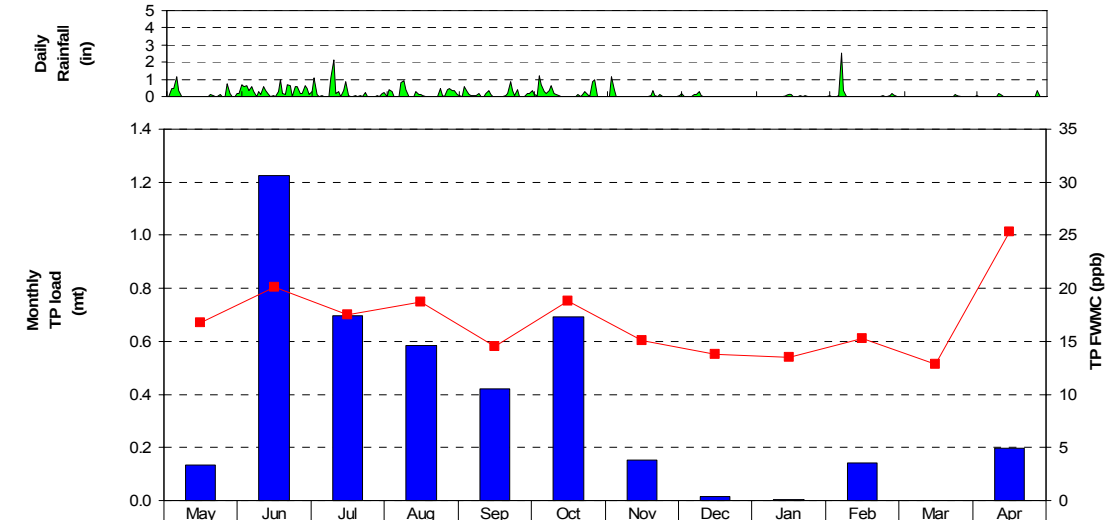
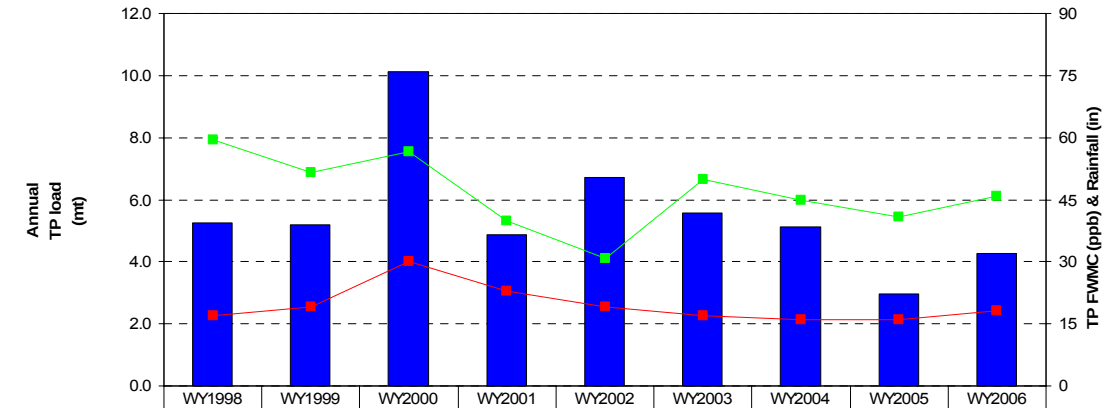


	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
TP Load (mt)	0.134	1.225	0.697	0.584	0.420	0.693	0.151	0.016	0.002	0.142	0.000	0.197
TP FWMC (ppb)	17	20	18	19	15	19	15	14	14	15	13	25
Rainfall (in)	3.9	10.6	7.0	5.7	4.6	6.3	2.5	0.6	0.5	3.3	0.2	0.7
Flow Vol. (kac-ft)	6.515	49.289	32.309	25.308	23.395	29.950	8.119	0.911	0.141	7.549	0.025	6.304

Figure 4-17a. C-11 West basin daily rainfall (top) and monthly TP load, FWM TP concentration, rainfall, and flow volume for WY2006 (bottom).



	WY1998	WY1999	WY2000	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006
TP load (mt)	5.250	5.193	10.125	4.881	6.716	5.580	5.122	2.972	4.262
TP FWMC (ppb)	17	19	30	23	19	17	16	16	18
Rainfall (in)	59.5	51.6	56.6	39.9	30.7	50.0	45.0	40.9	45.8
Flow Vol. (kac-ft)	250.350	221.585	273.612	172.045	283.618	264.301	257.317	149.987	189.815

Figure 4-17b. C-11 West basin annual TP load, FWM TP concentration, rainfall, and flow volume for WY1998–WY2006.

Source Control Strategy

The WQIP for the C-11 West basin includes a combination of on-going source control activities by basin stakeholders and integration with the Broward County Water Preserve Area (BCWPA) CERP Project. Source control activities include incorporating more stringent stormwater system permit requirements and maintenance programs; requiring landscape contractors to implement fertilizer and landscape maintenance BMPs; adopting ordinances supporting BMPs; implementing upstream monitoring to identify and respond to areas of concern; implementing operational changes to improve water pre-treatment; implementing local capital improvement projects that provide water quality benefits; and informing and educating residents on how they can protect the Everglades through workshops, special events, television, radio, mailings, web sites, brochures, and newsletters.

Update on Source Control Activities for C-11 West Basin

Summary of WY2006 Activities

During WY2006, the District and stakeholders continued the implementation of the WQIPs for the C-11 West basin, as detailed in Chapter 3 of the 2006 SFER – Volume I. Following is an update on each of these activities.

1. **Broward Everglades Working Group:** The District assisted Broward County in coordinating the countywide Broward Everglades Working Group (BEWG) to develop a comprehensive pollution reduction action plan with specific water quality goals and milestones for the C-11 West basin. The Final Broward County C-11 West Basin Pollution Reduction Action Plan by Broward Everglades Working Group – April 2006 (http://www.sfwmd.gov/org/erd/longtermplan/pdfs/C-11April_06_v2_wAppendix.pdf) can be found on the District's Long-Term Plan documents web site (http://www.sfwmd.gov/org/erd/longtermplan/documents.shtml).

2. **C-11 West Basin Nursery BMP Grant Program (Long-Term Plan Project "C-11 West Basin," FY2005–FY2006):** The District's and FDACS' C-11 West Basin Nursery BMP Grant Program began in May 2005. Twenty-nine nursery growers were awarded approximately $325,000 to implement BMPs. In June of 2006, FDACS' Florida Container Nursery BMP Guide for enhancing and protecting water quality was finalized and adopted by rule. Nurseries that commit to implement certain BMPs by submitting a Notice of Intent to FDACS receive a presumption of compliance with state water quality standards, a waiver of liability from recovery costs associated with the cleanup of drinking water wells, and/or contaminated surface water and eligibility for federal and state cost-share dollars for the implementation of specific practices. More information on FDACS' Nursery BMP Program is available at FDACS' Office of Agricultural Water Policy web site (http://www.floridaagwaterpolicy.com/BestManagementPractices.html).

3. **Western C-11 Impoundment Evaluations (Long-Term Plan Project "C-11 West Basin," FY2004–FY2005):** The District evaluated the potential water quality improvement benefits of connecting the Western C-11 Impoundment to the WCA-3A/3B Levee Seepage Management CERP projects and construction of internal enhancements to the Western C-11 Impoundment. These projects are part of the BCWPA CERP Project. The Broward County Water Preserve Areas - Stormwater Treatment Potential of C-11 Impoundment (Burns & McDonnell, 2006) can be found on the District's Long-Term Plan web site (http://www.sfwmd.gov/org/erd/longtermplan/documents.shtml). The results of the

evaluation indicated that the most effective strategy for reducing TP in discharges at the S-9 structure is to minimize the discharge volumes (through operational changes) rather than attempting to reduce TP in the impoundment. The evaluation was conducted in coordination with the CERP project implementation team and the District's Acceler8 team, and the recommendations are being evaluated for incorporation into the design of the CERP project features.

4. **BCWPA CERP Project:** The District has completed 30 percent of design of the BCWPA CERP Project. Flows from the C-11 West basin to WCA-3A will be significantly reduced once this project is completed in 2009 along with a significant reduction in the resulting TP load to Water Conservation Area 3A (WCA-3A). More detail on this project is available in Chapter 7A of this volume, at the CERP web site (www.evergladesplan.org), and the Acceler8 web site (www.evergladesnow.org).

5. **South Broward Drainage District Improvements:** The South Broward Drainage District (SBDD) completed a portion of the new drainage facilities for its S9/S10 sub-basin, which include replacement of unrestricted outfalls with control structures. SBDD has also closed one of its three unrestricted outfalls from its S8 sub-basin to the C-11 West canal and is still working in closing the other two. Completion of the S8 and S9/S10 sub-basins projects has been delayed until December 2007 because of emergency hurricane repair projects that have taken priority.

6. **Central Broward Water Control District (CBWCD) Improvements:** The CBWCD completed a portion of its capital improvement projects to increase the basin water storage capacity for improved flood control and water quality. The projected completion date is December 2007.

7. **Educational Videos (Long-Term Plan Project "C-11 West Basin," FY2005–FY2006):** The District renewed its contract with Comcast Cable Network for airing the five Everglades educational videos (30-second commercials), and over 2,000 commercial spots were scheduled to be aired on four major networks in the Broward County non-ECP basins (C-11 West, NNRC, and NSID) from April through November 2006. The District also undertook initiatives to also have the commercials aired on local community access channels from cities and towns in Broward County non-ECP basins. A Spanish version of the educational videos was produced as well.

8. **Know-The-Flow Education and Training Program:** Broward County has continued offering monthly Know-The-Flow workshops to property managers, homeowner associations, local government agencies, and other interested parties and individuals. The "Know-the-Flow" workshops present information about primary, secondary, and tertiary stormwater management systems as well as plant diversity, fertilization, and irrigation practices in layman terms.

9. **Everglades Website Development:** Links to the Districts' Everglades4Ever web site (www.sfwmd.gov/everglades4ever) and Broward County's Naturescape web site (www.broward.org/naturescape) have been provided on web sites of most Broward County stakeholders (municipalities, Chapter 298 districts, and others). The Everglades4Ever web site targets residents in general and includes reference to many of the activities previously described above.

10. **Urban BMPs (Long-Term Plan Project "C-11 West Basin," FY2005–FY2006):** The District developed a turf and landscape brochure, based upon the Turf and Landscape BMP "mini-web site." The brochure will be mailed out to residents in the Broward County non-ECP basins and made available at customer service desks of public works and utilities

offices. Also, the information of the brochures can be used for articles in news letters and as news flashes on web sites of members of the BEWG.

11. **Equine BMPs (Long-Term Plan Project "C-11 West Basin," FY2005–FY2006):** The District distributed in June 2006 an Equine BMP brochure called "Good Horse Sense" to horse owners and equine facilities in the C-11 West basin. Meanwhile, FDACS continues to develop a statewide Equine BMP manual. The Equine BMP manual is expected to be completed and adopted by rule in early 2007 for a statewide FDACS program implementation.

12. **Golf Course BMPs:** The District participated in the development of the FDEP's statewide Golf Course BMP manual. This manual is expected to be completed in early 2007.

Anticipated Activities for WY2007

In addition to continuing the source control activities previously described above, the following are planned for WY2007:

1. **C-11 West Basin Nursery BMP Grant Program:** FDACS, the Palm Beach Soil and Water Conservation Service District (PBSWCD), and the District will increase efforts to attract eligible growers for the next grant application cycles of the existing Nursery BMP Grant Program. The District will develop a BMP outreach program for small "back-yard" nurseries on residential properties.

2. **Equine BMPs:** The District will visit equine properties/facilities to evaluate the implementation of equine BMPs and, if requested, provide assistance with implementation.

3. **Golf Course BMPs:** The District will inform and educate golf course managers and maintenance personnel in Broward County non-ECP basins about golf course BMPs and, if requested, provide assistance with implementation.

4. **South Broward Drainage District Improvements:** SBDD will submit a permit modification request to implement operational changes to its S8 pump resulting in an additional 0.5-inch detention for improved water management and treatment.

5. **Public Education and Training:** The District will pursue the following public information and educational activities in the Broward County non-ECP basins: promoting the educational web site (www.sfwmd.gov/everglades4ever); airing of Spanish version of the educational videos; increasing the number of Know-The-Flow workshops; and participating in Broward County outreach events.

6. **Long-Term Plan Revisions:** The District will submit an application to FDEP for revisions to the Long-Term Plan projects to include implementation of additional source controls for all Broward County non-ECP basins. The proposed revisions will include the following:

    a. Extending the existing source control program timelines and funding for the period from FY2007–FY2010 to account for the latest CERP project timelines

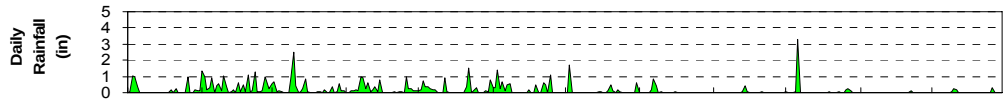
    b. Funding of components of the BCWPA CERP Project in order to ensure its completion by 2009

NORTH NEW RIVER CANAL (NNRC) BASIN UPDATE

WY2006 Phosphorus Results for NNRC Basin

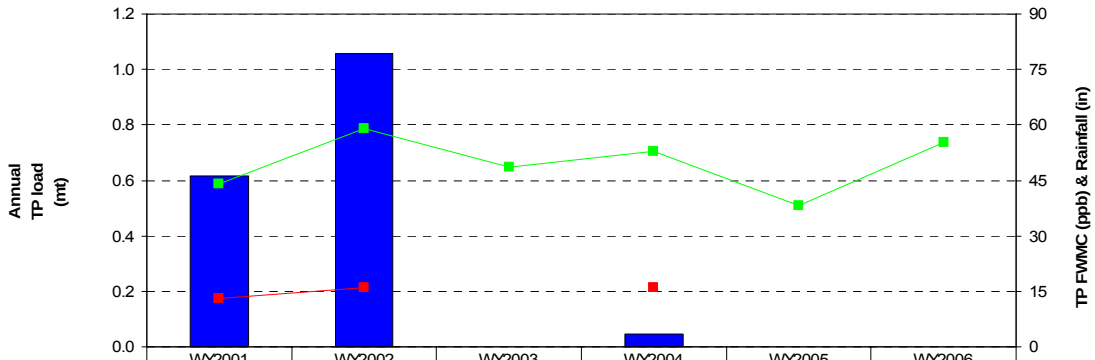
The NNRC basin in Broward County is able to discharge to the EPA, specifically WCA-3A, through structure G-123, although it seldom occurs. The structure is primarily used for water supply to WCA-3A, although it is sometimes necessary to use this structure for flood control during large storm events. Since December 2001 when the District implemented operational changes to the system for the purposes of water supply to the WCAs from this basin, there has been no flow or insignificant flow volumes discharged in the last four water years. There was no discharge from the NNRC basin to the EPA in WY2006.

Figure 4-18a summarizes the daily rainfall and the monthly TP load, FWM TP concentration, rainfall, and flow volume in WY2006 for the G-123 structure. **Figure 4-18b** summarizes the annual TP load, FWM TP concentration, and rainfall flow volume, for the G-123 structure from WY2001–WY2006. A summary of the upstream water quality data used to identify high phosphorus areas within the basin and a map of the NNRC basin showing these data are available online in the Non-ECP Upstream Monitoring WY2006 report on the District's Everglades Regulation Publications web site.



	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
TP Load (mt)	0	0	0	0	0	0	0	0	0	0	0	0
TP FWMC (ppb)	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
Rainfall (in)	4.3	12.9	7.3	6.8	6.8	6.7	3.4	1.6	0.7	4.0	0.1	0.7
Flow Vol. (kac-ft)	0	0	0	0	0	0	0	0	0	0	0	0

Figure 4-18a. North New River Canal basin daily rainfall (top) and monthly TP load, FWM TP concentration, rainfall, and flow volume for WY2006 (bottom) (NF = no flow for period).



	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006
TP Load (mt)	0.615	1.057	0	0.046	0	0
TP FWMC (ppb)	13	16	NF	16	NF	NF
Rainfall (in)	44.1	59.1	48.5	52.8	38.2	55.3
Flow Vol. (kac-ft)	38.379	52.047	0	2.299	0	0

Figure 4-18b. North New River Canal basin annual TP load, FWM TP concentration, rainfall, and flow volume for WY2001–WY2006 (NF = no flow for period). Note: G-123 flow and water quality data incomplete prior to WY2001.

Source Control Strategy

The WQIP for the NNRC basin includes a combination of on-going source control activities by basin stakeholders and integration with the WCA-2 and WCA-3 Diversion CERP Project. Source control activities include incorporating more stringent stormwater system permit requirements and maintenance programs; requiring landscape contractors to implement fertilizer and landscape maintenance BMPs; implementing upstream monitoring to identify and respond to areas of concern; implementing operational changes and local capital improvement projects that provide water quality benefits; and informing and educating residents on how they can protect the Everglades through workshops, special events, television, radio, mailings, web sites, brochures, and newsletters.

Update on Source Control Activities for NNRC Basin

Because this basin is also located in Broward County, some of the public information and education activities being implemented in the C-11 West basin also apply to the NNRC basin, and updates on some of the public information and education activities being implemented in the NNRC basin can be found in the C-11 West basin sub-section of this chapter.

Summary of WY2006 Activities

During WY2006, the District and stakeholders continued the implementation of the WQIPs for the NNRC basin as detailed in Chapter 3 of the 2006 SFER – Volume I. Following is an update on each of these activities:

1. **NNRC Flood Impact Analysis (Long-Term Plan Project "North New River Canal Basin," FY2004–FY2005):** The District completed a flood impact analysis in September 2005, to determine the impacts of discontinuing the use of structure G-123. The structure has historically provided flood relief under emergency conditions and the analysis results noted that discontinuing the use of G-123 for flood protection would adversely affect flood stages and, in severe storm events, increase the likelihood of property damage within the basin. The Flood Impact Analysis for the North New River Canal Basin - Task 3: Identification of Alternatives to Mitigate Potential Flood Impact (Earth Tech, 2005) can be found on the District's Long-Term Plan documents web site (http://www.sfwmd.gov/org/erd/longtermplan/documents.shtml). The flood impact analysis included an alternative with a preliminary estimate of $47 million for canal conveyance improvements and discontinuing the use of the G-123 structure to mitigate the flood impacts to the maximum extent possible. As an alternative to such a costly interim improvement, the analysis recommended a combination of thorough canal maintenance with investigation of potential obstructions and restriction of the flow together with revised operating protocols to reduce overall volumes discharged through G-123 to the EPA. A reduction in annual volumes together with source controls to reduce nutrient concentrations is anticipated to minimize nutrient load from the NNRC basin to the EPA until flows are completely diverted by the CERP project.
2. **Prediction Analysis for NNRC TP levels:** The District conducted an analysis of historic data to predict the long-term TP levels discharged from G-123 to WCA-3A based on the current operating criteria in response to the results of the flood impact analysis previously discussed above. The resulting annual average TP load was 0.030 mt/yr with an average discharge volume of 1.10 kac-ft/yr resulting in a calculated annual flow-weighted mean TP concentration of 22 ppb. Since discharge would be based on extreme storm conditions that

are not anticipated to occur every year, individual annual stormwater discharge volumes are expected to range from zero to approximately 5.55 kac-ft.

Anticipated Activities for WY2007

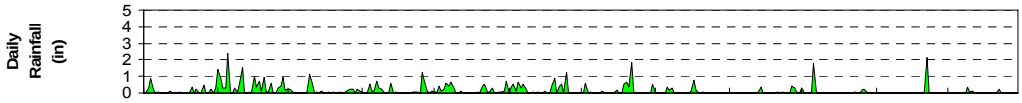
1. **Long-Term Plan Revisions:** Based on the findings of the flood impact and subsequent TP loading analyses, the District is working on proposed revisions to the Long-Term Plan to (1) allow continued operation of the G-123 structure until completion of the WCA-2 and WCA-3 Diversion CERP Project (currently planned after 2020), only as may be absolutely necessary for water supply emergencies or emergency flood protection within the basin; and (2) extend the existing source control program timelines and funding for the period from FY2007–FY2010.

NORTH SPRINGS IMPROVEMENT DISTRICT (NSID) BASIN UPDATE

WY2006 Phosphorus Results for NSID Basin

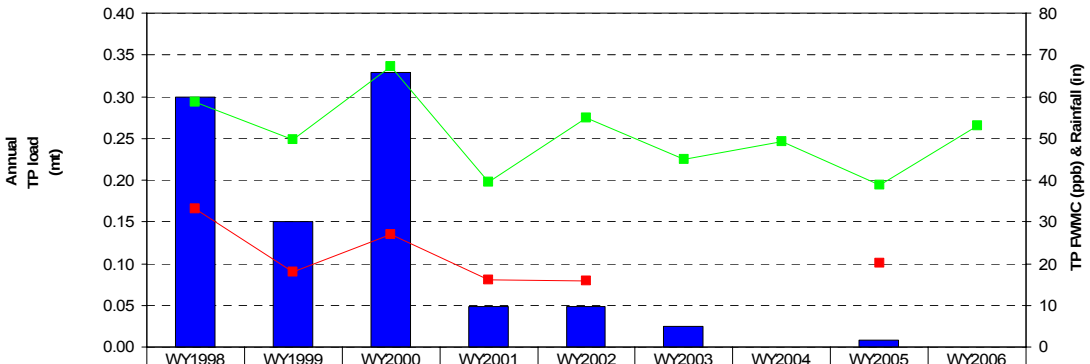
The North Springs Improvement District (NSID) basin in Broward County is able to discharge to the EPA, specifically WCA-2A, through NSID Pump Station 1 (NSID1); however, it is only allowed when the stormwater conveyance system that normally discharges to tide exceeds its capacity. The basin did not discharge to the EPA during WY2006. Pump management BMPs that were implemented in WY2001 drastically reduced the frequency and volume of pumping to the EPA. The last two confirmed discharges from NSID1 into WCA-2A occurred in July 2002 and September 2004.

Figure 4-19a summarizes the daily rainfall and the monthly TP load, FWM TP concentration, rainfall, and flow volume in WY2006 for the NSID1 structure. **Figure 4-19b** summarizes the annual TP load, FWM TP concentration, and rainfall flow volume, for the NSID1 structure from WY1998–WY2006. A summary of the upstream water quality data used to identify high phosphorus areas within the basin and a map of the NSID basin depicting these sites are available online in the Non-ECP Upstream Monitoring WY2006 report on the District's Everglades Regulation Publications web site.



	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
TP Load (mt)	0	0	0	0	0	0	0	0	0	0	0	0
TP FWMC (ppb)	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
Rainfall (in)	3.4	13.9	3.8	5.3	5.4	6.7	5.2	2.1	1.6	2.5	2.2	0.9
Flow Vol. (kac-ft)	0	0	0	0	0	0	0	0	0	0	0	0

Figure 4-19a. North Springs Improvement District basin daily rainfall (top) and monthly TP load, FWM TP concentration, rainfall, and flow volume for WY2006 (bottom) (NF = no flow for period).



	WY1998	WY1999	WY2000	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006
TP Load (mt)	0.300	0.150	0.329	0.048	0.049	0.025 *	0	0.009	0
TP FWMC (ppb)	33	18	27	16	16	NDF	NF	20	NF
Rainfall (in)	58.8	49.8	67.1	39.6	54.9	45.0	49.2	38.7	53.0
Flow Vol. (kac-ft)	7.364	6.762	9.881	2.412	2.494	0.688	0	0.354	0

Figure 4-19b. North Springs Improvement District basin (NSID1) annual TP load, FWM TP concentration, rainfall, and flow volume for WY1998–WY2006 (NF = no flow for period; NDF = no data with flow available).

* calculated with annual flow and arithmetic mean concentration

Source Control Strategy

The WQIP for the NSID basin includes a combination of on-going source control activities by basin stakeholders and integration with the Hillsboro Site 1 Impoundment CERP Project. Source control activities include incorporating more stringent stormwater system permit requirements and maintenance programs; requiring landscape contractors to implement fertilizer and landscape maintenance BMPs; implementing upstream monitoring to identify and respond to areas of concern; implementing operational changes that provide water quality benefits; and informing and educating residents on how they can protect the Everglades through workshops, special events, television, radio, mailings, web sites, brochures, and newsletters.

Update on Source Control Activities for NSID Basin

Because this basin is also located in Broward County, some of the public information and education activities being implemented in the C-11 West basin also apply to the NSID basin, and updates on some of the public information and education activities being implemented in the NSID basin can be found in the C-11 West basin sub-section of this chapter.

Summary of WY2006 Activities

During WY2006, the District and stakeholders continued the implementation of the WQIPs for the NSID basin, as detailed in Chapter 3 of the 2006 SFER – Volume I. Following is an update on each of these activities:

1. **BMP Cooperative Agreement (Long-Term Plan Project "North Springs Improvement District Basin," FY2006):** The NSID and District initiated in May 2006 a BMP cooperative cost share agreement in the amount of $27,610.60 for implementation of BMPs and operational measures to further improve water quality in discharges to the EPA. Telemetry with remote pump control, level sensors, pump discharge adjustment, and other important operational appurtenances are planned be installed and utilized to maximize pumping efficiencies and further reduce the need to pump into WCA-2A.
2. **NSID/Hillsboro Canal Evaluations (Long-Term Plan Project "North Springs Improvement District Basin," FY2004–FY2006):** The District reviewed potential mitigation measures associated with predicted water elevation increases in the Hillsboro Canal caused by redirection of NSID flows, as part of the 2003 Long-Term Plan recommendations to perform hydraulic evaluations. The Evaluation of Alternatives for Elimination of Stormwater Discharges from NSID to the Everglades Protection Area - Task 4 – Cost Estimating for Alternatives (A.D.A. Engineering, 2005) can be found on the District's Long-Term Plan documents web site (http://www.sfwmd.gov/org/erd/longtermplan/documents.shtml). The evaluation includes an estimate of the 50-year present value cost of almost $17 million associated with conveyance improvements to the canals and the G-56 tidal structure. Alternatively, costs for an impoundment site were estimated to be between $57 million and $133 million depending largely on land acquisition costs. The expenditure for these mitigation measures may be unfeasible, or at least impractical, considering the relatively small TP load estimated to be diverted from the EPA.
3. **Prediction Analysis for NSID TP Levels:** The District evaluated the potential TP loads that could be expected to enter the EPA during large storm events to provide a basis for future decision making. Based on WY2001–WY2005 TP concentration data collected

during flow events and flow data from the most recent 2x2 model, the average annual TP load to the EPA from NSID is estimated at 0.007 mt. This load is significantly less than the estimation from the 2002 Basin Specific Feasibility Studies (BSFS), which calculated annual loads of 0.293 mt based on a TP concentration of 39 ppb. The previous estimates used for Long-Term Plan recommendations are no longer applicable because of the improved water quality and revised operational criteria for NSID.

Anticipated Activities for WY2007

1. **Long-Term Plan Revisions:** Based on the findings of the hydraulic evaluation and previous Long-Term Plan recommendations, the District will propose revisions to the Long-Term Plan to (1) allow diversion of current NSID basin discharges away from WCA-2A to the CERP Hillsboro Site 1 Project, except as necessary to maintain regional flood protection; and (2) extend the timelines and funding to continue existing source control programs for the NSID basin for the period from FY2007–FY2010.
2. **Hillsboro Site 1 Impoundment CERP Project:** The first phase of construction associated with the Hillsboro Site 1 Impoundment CERP Project includes increasing conveyance by constructing a new structure (S-527B) to replace structure S-39A, located at the north end of the L-36N borrow canal where flows enter the Hillsboro Canal. Installation of the new structure is planned to be completed in April 2007. More detail on this project is available in Chapter 7A of this volume, at the CERP web site (www.evergladesplan.org), and the Acceler8 web site (www.evergladesnow.org).

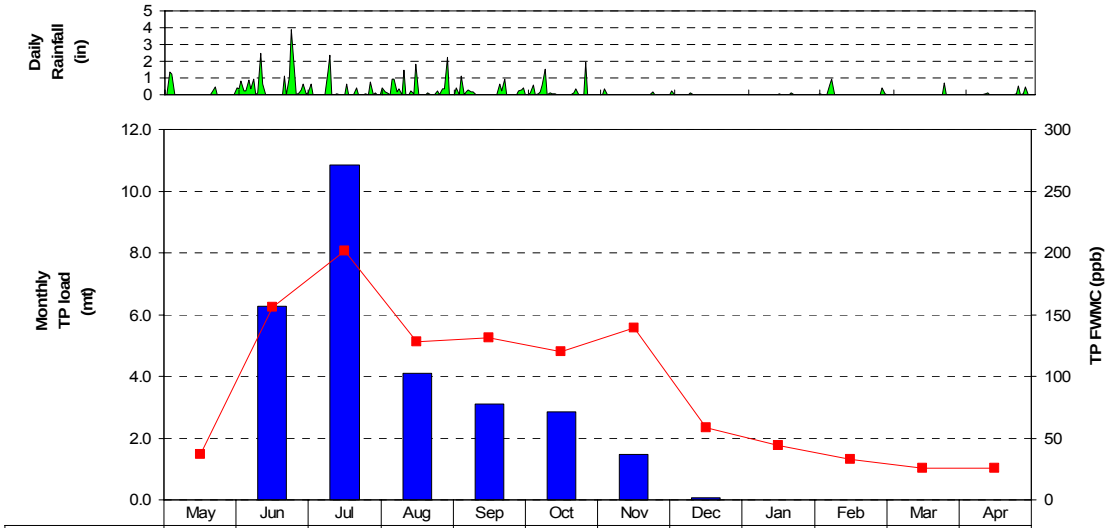
FEEDER CANAL BASIN UPDATE

WY2006 Phosphorus Results for Feeder Canal Basin

The Feeder Canal basin is located in Hendry County. This basin is divided into three major sub-basins: North Feeder sub-basin (McDaniel Ranch), a portion of the Big Cypress Seminole Indian Reservation, and the West Feeder sub-basin (comprised of multiple private landowners). The canals and structures within this basin provide flood protection and convey excess runoff to WCA-3A for water supply and environmental use. Discharges occur at the lower southeastern corner of the basin through the S-190 structure into the L-28 Interceptor Canal and, eventually, into WCA-3A.

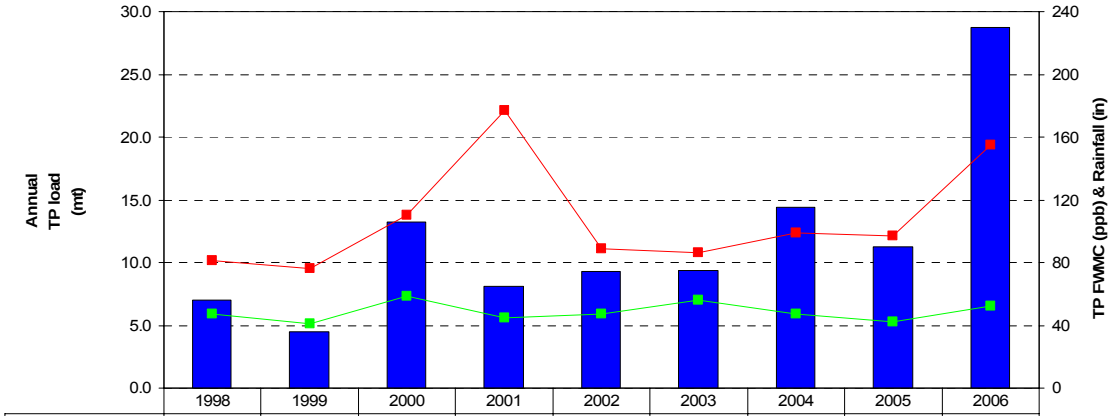
Figure 4-20a summarizes the daily rainfall and the monthly TP load, FWM TP concentration, rainfall, and flow volume in WY2006 for the S-190 structure. **Figure 4-20b** summarizes the annual TP load, FWM TP concentration, and rainfall flow volume, for the S-190 structure from WY1998–WY2006. The S-190 FWM TP concentration and TP load for WY2006 were 155 ppb and 28.72 mt, respectively. The TP load is the highest recorded for the last nine water years. The large TP load in WY2006 may be explained by the intense rainfall events experienced during the months of June–August 2005 (see **Figure 4-20a**).

Upstream water quality data to identify high phosphorus areas within the Feeder Canal basin are collected from the McDaniel Ranch, the West Feeder sub-basin and the Seminole Tribe, and maps can be found online in the Non-ECP Upstream Monitoring WY2006 report on the District's Everglades Regulation Publications and Seminole Agreement Working Group Progress Reports web sites.



	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
TP Load (mt)	0.001	6.277	10.857	4.093	3.096	2.862	1.465	0.050	0.001	0.010	0.004	0.000
TP FWMC (ppb)	37	156	202	128	131	120	139	58	44	33	26	26
Rainfall (in)	3.7	15.9	6.9	10.1	4.8	5.7	0.9	0.1	0.2	2.0	0.7	1.3
Flow Vol. (kac-ft)	0.014	32.634	43.652	25.955	19.159	19.291	8.548	0.703	0.021	0.243	0.136	0.002

Figure 4-20a. Feeder Canal basin daily rainfall (top) and the monthly TP load, FWM TP concentration, rainfall, and flow volume for WY2006 (bottom).



	1998	1999	2000	2001	2002	2003	2004	2005	2006
TP Load (mt)	7.026	4.453	13.241	8.141	9.329	9.358	14.410	11.288	28.717
TP FWMC (ppb)	81	76	110	177	89	86	99	97	155
Rainfall (in)	47.3	41.0	58.4	44.9	47.0	56.4	47.5	42.0	52.3
Flow Vol. (kac-ft)	70.317	47.504	97.586	37.286	84.982	88.026	117.699	94.581	150.359

Figure 4-20b. Feeder Canal basin annual TP load, FWM TP concentration, rainfall, and flow volume for WY2006.

Source Control Strategy

The WQIP for the Feeder Canal basin consists of a combination of a voluntary BMP incentive program, mandatory BMPs, and integration with the Big Cypress/L-28 Interceptor Modifications CERP Project and the Seminole Tribe Big Cypress Reservation Water Conservation Plan (WCP). Mandatory BMPs are required by a landowner's agreement between the McDaniel Ranch and the Seminole Indian Tribe of Florida (Landowner's Agreement). The agreement also requires that discharges from McDaniel Ranch meet a "target level" of 50 ppb TP.

Update on Source Control Activities for Feeder Canal Basin

Summary of WY2006 Activities

During WY2006, the District and stakeholders continued the implementation of the WQIPs for the Feeder Canal basin, as detailed in Chapter 3 of the 2006 SFER – Volume I. Following is an update on each of these activities:

1. **C-139 and Western Basins BMP Grant Program (Long-Term Plan Project "Feeder Canal Basin," FY2004–FY2006):** The District established a BMP Grant Incentive Program in FY2002 in the C-139 and Western basins, which continued through FY2006. As of July 2006, approximately $500,000 was awarded to BMP implementation projects within the Feeder Canal basin. Annual update reports, C-139 and Western Basins Best Management Practices Grant Program Report, which provide detailed descriptions of the grant program and projects funded since FY2002, can be found on the District's Everglades Regulation Publications web site.

2. **Seminole Tribe WCP Project:** The District continues to track the progress of the project. The Seminole Tribe and the U.S. Army Corps of Engineers (USACE) were in the process of awarding construction contracts for some components of the Seminole Tribe WCP project. The project, currently scheduled to be completed by late 2008, is designed to improve water quality, restore wetland hydrology, increase water storage capacity, and enhance flood protection within the reservation.

3. **McDaniel Ranch Surface Water Management System:** The District approved the McDaniel Ranch surface water management system permit modification on July 12, 2006. This permit modification covers 18,340.5 acres and addresses changes to the drainage system to provide water quality treatment prior to discharge as well as a schedule for completion of construction by June 2007. The District initiated the review of a surface water management system permit application to convert 3,256.8 acres, formerly owned by McDaniel Ranch, from intensive agricultural use to a residential equine development. The new drainage system will be required to address water quality in discharges.

4. **Big Cypress/L-28 Interceptor Modifications CERP Project:** The District pursued alternatives to accelerate the completion of the Big Cypress/L-28 Interceptor Modifications CERP Project. In WY2005, the District learned that the timeline for this project could not be accelerated for completion by 2009 as recommended by the Long-Term Plan due to funding constraint. The current projected completion date is after 2015. The District will continue to pursue alternatives to accelerate this project.

5. **Additional Upstream Monitoring:** The District began collecting water samples (grabs) at six locations within the West Feeder Canal sub-basin. The samples are collected weekly, if flowing, during the wet season (April 1–October 30). The parameters tested are TP, total

dissolved phosphorus (represents total soluble phosphorus or TSP), and ortho-phosphorus (represents soluble reactive phosphorus or SRP). These sampling locations give "snapshots" of phosphorus concentrations throughout the sub-basin and will be used to confirm the level of success from existing BMPs or highlight the need for additional BMPs. To date, weekly samples from September 29, 2005 through November 11, 2005, have been collected at the six sites. The sampling began again on April 5, 2006, and weekly samples will be collected through October 31, 2006.

Anticipated Activities for WY2007

1. **Trend analysis:** The District will continue monitoring TP levels in the basin to evaluate trends and contributing factors. The intense rainfall events experienced during the months of June 2005 through August 2005 seem to have adversely affected the TP levels recorded for WY2006.
2. **McDaniel Ranch Surface Water Management System:** The District will work with McDaniel Ranch to ensure compliance with their surface water management system permit, to optimize their BMP plan, and to develop potential BMP demonstration projects that will further improve water quality in their discharges with the goal of meeting a "target level" of 50 ppb TP.
3. **Long-Term Plan Revisions:** The District will propose revisions to the Long-Term Plan to incorporate current water quality improvement plans and schedules for the Seminole Tribe WCP and the McDaniel Ranch (for currently and formerly owned lands). The revision will also reflect the current schedule of completion for the Big Cypress/L-28 Interceptor Modifications CERP Project. The proposed revisions will include extending the existing source control program timelines and funding for the period from FY2007–FY2009 to account for the latest construction project timelines.

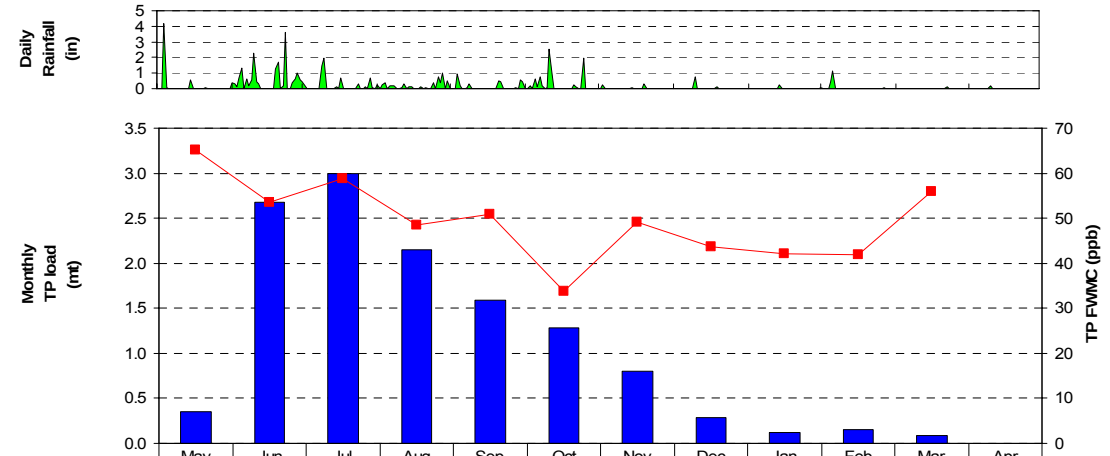
L-28 BASIN UPDATE

WY2006 Phosphorus Results for L-28 Basin

The L-28 basin is located within portions of Broward, Hendry, and Collier counties and is entirely occupied by four landowners: the C-139 Annex, the Big Cypress Seminole Indian Reservation, the Miccosukee Indian Reservation, and the Big Cypress National Preserve. The surface water management system in the L-28 basin provides drainage and flood protection in addition to providing water supply to WCA-3A when necessary. The L-28 borrow canal is the primary drainage canal conveying stormwater runoff to the S-140 structure which discharges directly into WCA-3A.

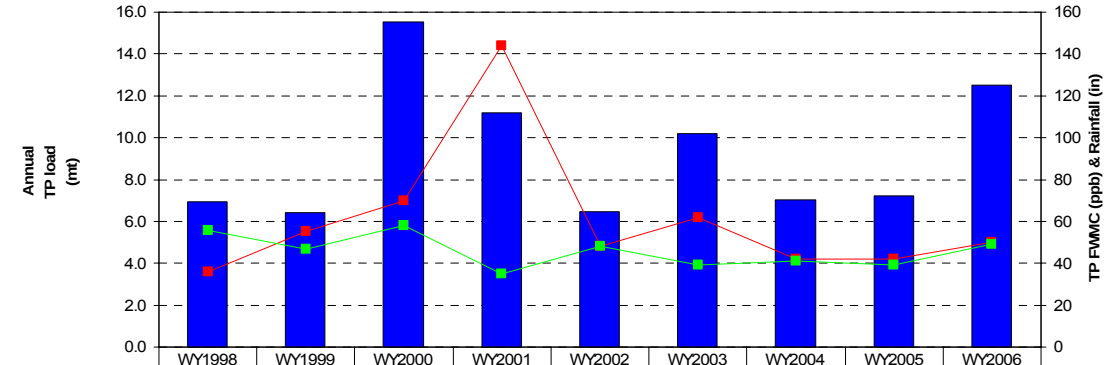
Figure 4-21a summarizes the daily rainfall and the monthly TP load, FWM TP concentration, rainfall, and flow volume in WY2006 for the S-140 structure. **Figure 4-21b** summarizes the annual TP load, FWM TP concentration, and rainfall flow volume, for the S-140 structure from WY1998–WY2006. The S-140 FWM TP concentration and TP load for WY2006 were 50 ppb and 12.51 mt, respectively.

Upstream water quality data for the C-139 Annex sub-basin and the Seminole Tribe, and maps can be found online in the Non-ECP Upstream Monitoring WY2006 report on the District's Everglades Regulation Publications and the Seminole Agreement Working Group Progress Reports web sites.



	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
TP Load (mt)	0.356	2.675	2.993	2.154	1.589	1.283	0.804	0.290	0.120	0.159	0.084	0
TP FWMC (ppb)	65	54	59	48	51	34	49	44	42	42	56	NF
Rainfall (in)	5.0	17.2	6.0	5.1	3.6	7.9	0.8	0.9	0.4	1.8	0.2	0.2
Flow Vol. (kac-ft)	4.431	40.489	41.324	36.038	25.276	30.768	13.287	5.376	2.301	3.066	1.221	0

Figure 4-21a. L-28 basin daily rainfall (top) and monthly TP load, FWM TP concentration, rainfall, and flow volume for WY2006 (bottom) (NF = no flow for period).



	WY1998	WY1999	WY2000	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006
TP Load (mt)	6.920	6.414	15.543	11.185	6.460	10.191	7.018	7.215	12.507
TP FWMC (ppb)	36	55	70	144	48	62	42	42	50
Rainfall (in)	55.7	46.8	58.0	35.0	48.2	39.0	41.3	39.2	49.0
Flow Vol. (kac-ft)	155.848	94.543	180.011	62.972	109.994	136.367	136.152	137.976	203.575

Figure 4-21b. L-28 basin annual TP load, FWM TP concentration, rainfall, and flow volume for WY2006.

Source Control Strategy

The WQIP for the L-28 basin consists of a combination of diversion of C-139 Annex flows to STA-6 by December 2006, and integration with the CERP Project Component RR4, the Miccosukee Tribe Water Management Plan (WMP) and the Seminole Tribe WCP. The CERP Project Component RR4, currently scheduled to be completed after 2015, includes the relocation and enlargement of the S-140 pump structure to improve hydro-period restoration in the western portion of WCA-3A and increase flows to the region. The Seminole Tribe WCP, implemented under the Natural Resource Conservation Service (NRCS) PL-83-566 Small Watershed Project Program, proposes construction of 3,835 acres of retention areas designed to improve water quality for flows from the Seminole Reservation lands only and it is currently planned for completion in 2010. The Miccosukee Tribe WCP, currently scheduled to be completed after 2015, is a critical project to construct a managed wetland on the Miccosukee Indian Reservation. The project will convert approximately 900 acres of tribally owned cattle pastures into wetland retention/detention to provide water storage capacity, as well as water quality enhancement for Miccosukee Indian Reservation lands water that will be discharged to WCA-3A through the S-140 pump station.

Update on Source Control Activities for L-28 Basin

Summary of WY2006 Activities

During WY2006, the District and stakeholders continued the implementation of the WQIPs for the L-28 basin, as detailed in Chapter 3 of the 2006 SFER – Volume I. Following is an update on each of these activities:

1. **C-139 Annex Diversion:** The District began the expansion of STA-6 (addition of Section 2) in February 2006 under its Acceler8 Program. The STA-6 Section 2 project is currently scheduled to be flow-capable by December 31, 2006. U.S. Sugar Corporation (USSC) initiated construction of the new pump station that will divert runoff from the C-139 Annex to Sections 1 and 2 of STA-6. Completion of the USSC pump station is expected by December 31, 2006. The District is working with USSC to develop a compliance TP limit to ensure that C-139 Annex discharges do not exceed historical levels and STA-6 (Sections 1 and 2) design loads.
2. **Seminole Tribe WCP Project:** The District continues to track the progress of the project. The Seminole Tribe has completed the conceptual engineering design of the Seminole Tribe WCP, and its construction completion is projected for 2010. The Long-Term Plan recommended modification of the plan to convert Water Retention Area 7 (WRA-7) to an STA by 2010 at a cost of approximately $20 million; however, as of the end of WY2006, this modification had not been authorized.
3. **Miccosukee Tribe WMP Project:** The Long-Term Plan recommended the accelerated completion by 2010 of the Miccosukee WMP; however, funding for this project has not yet been authorized and the project is currently scheduled to be completed after 2015.

Anticipated Activities for WY2007

1. **C-139 Annex Diversion:** The District will finalize the C-139 Annex compliance methodology for water quality in discharges to STA-6.

2. **Long-Term Plan Revisions:** The District will propose revisions to the Long-Term Plan to incorporate current water quality improvement plans and schedules for the Seminole Tribe WCP and the Miccosukee WMP. The District will evaluate potential options to accelerate completion of the Miccosukee WMP by 2010 (currently scheduled for 2015) and to construct an STA within WRA-7 by 2010, as recommended by the 2003 Long-Term Plan.

C-111 BASIN UPDATE

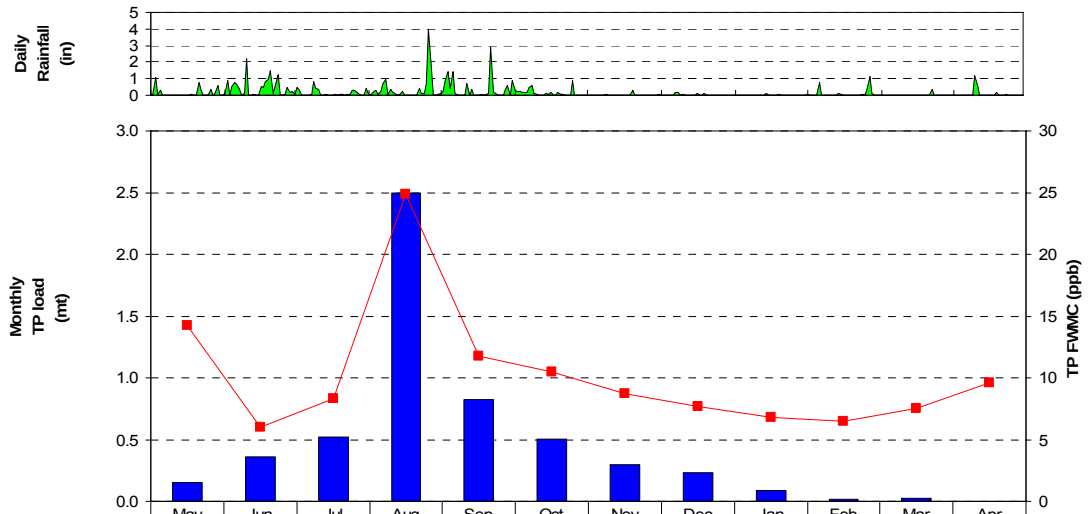
Phosphorus Results for C-111 Basin

The C-111 basin is located in the southernmost portion of Miami-Dade County adjacent to the Everglades National Park (ENP). Canals in this basin provide drainage and flood protection, water supply, and protection from saltwater intrusion into local groundwater. Discharges from this basin are directed to the ENP, specifically to Taylor Slough (by way of the L-31N borrow and L-31W borrow canals) and the ENP's panhandle (by way of the C-111 canal).

As part of the C-111 project, a series of three interconnected detention cells, divided by berms, and a flow-way cell were constructed and the levee in the L-31W borrow canal, just north of S-332, was degraded. Water from L-31N borrow canal is pumped westward by pump station S-332D to these detention areas. The detention areas serve as basins for groundwater recharge. Also sedimentation and filtration can take place to improve water quality. The portion of water pumped by S-332D along with direct rainfall that does not recharge to groundwater or evaporate is discharged to ENP through the degraded levee. Therefore, the S-332 and S-175 structures will not be used for discharges to the ENP, but they will be maintained and kept operational for emergency events in case additional flood relief is required. Consequently, a permit modification for the non-ECP permit was issued in July 2006 to reclassify the S-332 and S-175 structures as "within" structures, to reclassify the S-332D and S-174 structures as "into" structures, and to add berm B3 as a "within" structure.

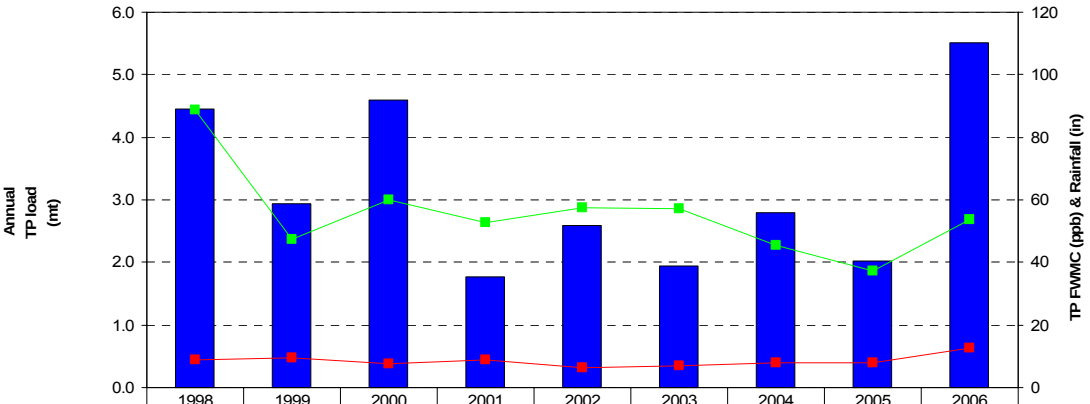
Figure 4-22a summarizes the daily rainfall and the monthly TP load, FWM TP concentration, rainfall, and flow volume in WY2006 from the C-111 basin to the ENP. **Figure 4-22b** summarizes the annual TP load, FWM TP concentration, and rainfall flow volume, for the C-111 basin to the ENP from WY1998–WY2006. As mentioned above, a change in designation for the S-332D and S-174 structure occurred during WY2006. The S-18C, S-332D, and S-174 combined FWM TP concentration and TP load for WY2006 were 13 ppb and 5.51 mt, respectively. The increase in the TP load and concentration may be explained by excessive rainfall in the last week of August 2005 associated with Hurricane Katrina (**Figure 4-22a**).

Water quality data and maps for upstream structures S-176, S-178, and S-332B, as well as the former "into" (now "within") structures S-175 and S-332 can be found online in the Non-ECP Upstream Monitoring WY2006 report on the District's Everglades Regulation Publications site. In WY2006, there was no discharge through S-332 other than maintenance related. Also, in WY2006, S-175 structure was used for flood protection after excessive rainfall associated with Hurricane Katrina.



	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
TP Load (mt)	0.149	0.358	0.516	2.499	0.821	0.504	0.299	0.232	0.087	0.019	0.024	0.002
TP FWMC (ppb)	14	6	8	25	12	11	9	8	7	6	8	10
Rainfall (in)	3.7	13.1	4.0	11.3	10.9	3.9	0.6	0.9	0.4	2.6	0.4	2.1
Flow Vol. (kac-ft)	8.472	48.408	50.190	81.328	56.647	38.898	27.739	24.330	10.410	2.317	2.619	0.151

Figure 4-22a. C-111 basin daily rainfall (top) and the monthly TP load, FWM TP concentration, rainfall, and flow volume for WY2006 (bottom).



	1998	1999	2000	2001	2002	2003	2004	2005	2006
TP Load (mt)	4.456	2.936	4.595	1.761	2.585	1.942	2.793	2.025	5.509
TP FWMC (ppb)	9	9	8	9	6	7	8	8	13
Rainfall (in)	88.8	47.4	60.1	52.8	57.3	57.1	45.5	37.4	53.8
Flow Vol. (kac-ft)	414.943	251.503	490.742	160.613	330.985	231.507	292.298	207.228	351.511

Figure 4-22b. C-111 basin annual TP load, FWM TP concentration, rainfall, and flow volume for WY1998–WY2006.

Note: WY1998–WY2000 represented by structures S-18C, S-175, and S-332
WY2001–WY2006 represented by structures S-18C, S-174, and S-332D

Source Control Strategy

The WQIP for the C-111 basin consists of a combination of BMP outreach activities through the University of Florida institutions and integration with the C-111 Project, the C-111 Spreader Canal CERP Project, the Modified Water Deliveries (MWD) Project, and the Combined Structural and Operational Plan (CSOP). The C-111 Project and the C-111 Spreader Canal CERP Project consist of modifications to the Central & Southern Florida Project (C&SF), as authorized by the 1994 C-111 General Re-engineering Report (GRR), to restore the ecosystem in Taylor Slough and the Eastern Panhandle of the ENP. The MWD Project is a federal project designed to improve water deliveries to ENP by restoring WCA-3B and Northeast Shark Slough as a functioning component of the historical Shark Slough hydrologic system. None of the features authorized under the MWD Project is located within the C-111 basin. CSOP will integrate and possibly modify the structural components of the MWD and C-111 projects into an operational plan that will maximize restoration while preserving other project purposes and explore opportunities for enhanced performance.

Update on Source Control Activities for C-111 Basin

Summary of WY2006 Activities

During WY2006, the District and stakeholders continued the implementation of the WQIPs for the C-111 basin as detailed in Chapter 3 of the 2006 SFER – Volume I. Following is an update on each of these activities:

1. **C-111 Basin Nursery BMP Grant Program:** FDACS has started a nursery BMP grant program for the C-111 basin similar to the one in the C-11 West basin. The C-111 grant program is based on the same principles as the C-11 West Basin but funding is provided solely by FDACS.
2. **Mobile Irrigation Lab:** The District, in partnership with NRCS, continues to sponsor the Mobile Irrigation Lab in this area to help local growers improve their irrigation practices. Also, the main sources of public information and education in this basin continue to be the University of Florida's Tropical Research and Education Center and IFAS.
3. **C-111 Project:** The District has completed the land acquisition required for the next construction phase and is completing the acquisition of the remaining approximately 150 acres required for final construction phase (5,172 acres of the required 5,322 acres have been acquired). Construction of a continuous detention area from S-332B to the Frog Pond (northern levee of the S-332D detention area) will increase the detention area of approximately 700 acres currently available (S-332B North 240 acres, S-332B West 160 acres, S-332C 300 acres) by approximately 1,000 acres, providing a total of about 1,700 acres. This construction was scheduled for the November 2006 through April 2007 dry season but has been delayed to the November 2007 through April 2008 dry season due to insufficient funding by the USACE. Construction of the final (northern detention area between S-332B North and the 8.5 SMA STA) is expect to occur in the November 2008 through April 2009 dry season.
4. **C-111 Spreader Canal CERP Project:** The District has completed 30 percent of design of the C-111 Spreader Canal CERP Project. The ecological system of the Southern Glades and Model Lands including downstream estuaries will have improved water quantity, timing, and distribution once the first phase of this project is completed in 2010. More detail on this

project is available in Chapter 7A of this volume, at the CERP web site (www.evergladesplan.org), and the Acceler8 web site (www.evergladesnow.org).

5. **CSOP:** A Record of Decision for the CSOP is expected in the fourth quarter of 2007. It is expected that the CSOP will recommend several design refinements to the C-111 Project, modifying or replacing structural changes authorized by the 1994 GRR.

Anticipated Activities for WY2007

1. **Educational Videos:** Because of the increase in residential development in this basin, the District plans to have the five 30-second video commercials, "From our Gutter to the Glades," broadcasted on local community access channels.

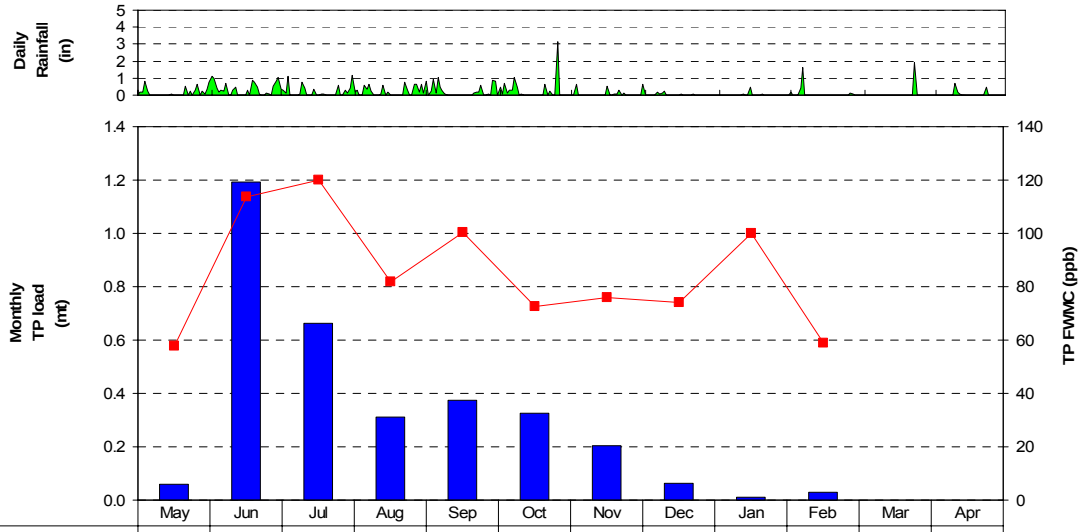
VILLAGE OF WELLINGTON (VOW) ACME IMPROVEMENT DISTRICT UPDATE

WY2006 Phosphorus Results for VOW

The VOW ACME Improvement District basin occupies approximately 30 square miles and is located east of WCA-1 and in Palm Beach County. The VOW basin is divided into two sub-basins, Basins A and B. The majority of stormwater from Basin B, and limited drainage overflows from the northern Basin A, discharge via two pumps known as ACME1 and ACME2 to the EPA, specifically WCA-1.

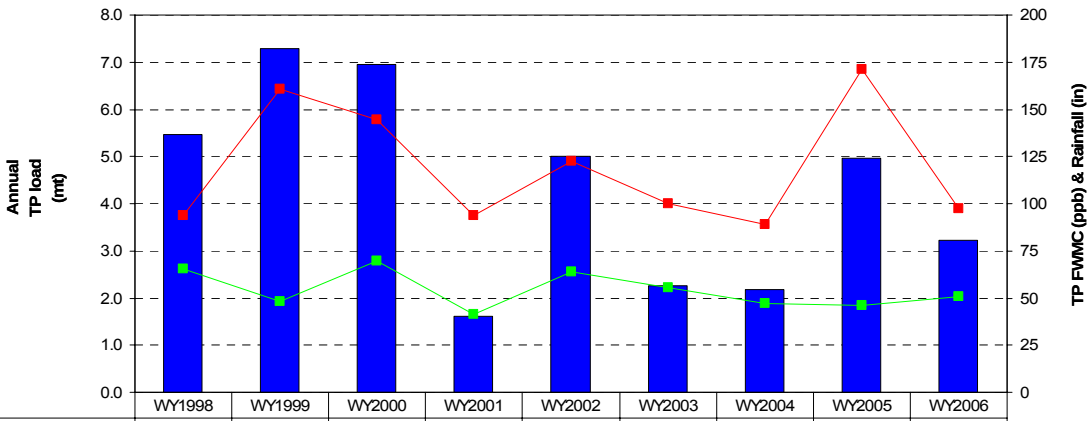
Figure 4-23a summarizes the daily rainfall and the monthly TP load, FWM TP concentration, rainfall, and flow volume in WY2006 for the ACME1 and ACME2 structures. **Figure 4-23b** summarizes the annual TP load, FWM TP concentration, and rainfall flow volume, for the ACME1 and ACME2 structures from WY1998–WY2006. The ACME1 and ACME2 combined FWM TP concentration and TP load for WY2006 were 97 ppb and 3.24 mt, respectively. Although not the lowest annual TP concentration on record, it is well below the previous year's value of 171 ppb and the long-term FWMC of 122 ppb for all discharges from WY1998 through WY2006.

A summary of the upstream water quality data used to identify high phosphorus areas within the basin and a map of the VOW basin showing these data are available online in the Non-ECP Upstream Monitoring WY2006 report on the District's Everglades Regulation Publications web site.



	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
TP Load (mt)	0.059	1.194	0.665	0.312	0.373	0.325	0.203	0.062	0.012	0.031	0	0
TP FWMC (ppb)	58	114	120	82	100	73	76	74	100	59	NF	NF
Rainfall (in)	4.6	9.9	6.0	7.2	6.4	7.0	2.4	0.7	0.8	2.3	2.0	1.5
Flow Vol. (kac-ft)	0.837	8.513	4.483	3.083	3.015	3.622	2.174	0.680	0.100	0.421	0	0

Figure 4-23a. VOW ACME Improvement District basin daily rainfall (top) and monthly TP load, FWM TP concentration, rainfall, and flow volume for WY2006 (bottom).



	WY1998	WY1999	WY2000	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006
TP Load (mt)	5.469	7.278	6.947	1.612	5.006	2.254	2.184	4.969	3.235
TP FWMC (ppb)	94	161	144	94	122	100	89	171	97
Rainfall (in)	65.6	48.3	69.7	41.6	63.7	55.6	47.1	45.9	50.8
Flow Vol. (kac-ft)	47.292	36.734	39.010	13.948	33.194	18.282	19.889	23.563	26.928

Figure 4-23b. VOW ACME Improvement District basin annual TP load, FWM TP concentration, rainfall, and flow volume for WY1998–WY2006.

Source Control Strategy

The WQIP for the VOW basin consists of a combination of ongoing public information and education initiatives, mandatory BMPs required by existing VOW BMP ordinances, additional water quality requirements in stormwater management system permit conditions, and integration with the ACME Basin B Discharge CERP Project and the ACME Improvement District Basin B Long-Range Plan Project. The ACME Basin B Discharge CERP Project includes improvements to the ACME C-1 canal and construction of a pump station to allow diversion of Basin B flows to STA-1E by way of the C-51 canal. The ACME Improvement District Basin B Long-Range Plan Project is being implemented by the VOW in coordination with the ACME Basin B Discharge CERP Project. It includes significant improvements to VOW's conveyance system to make flood protection possible without discharging directly to WCA-1.

Update on Source Control Activities for VOW

Summary of WY2006 Activities

During WY2006, the District and VOW continued the implementation of the WQIPs for the ACME Basin B, as detailed in Chapter 3 of the 2006 SFER – Volume I. Following is an update on each of these activities:

1. **BMP Cooperative Agreement (Long-Term Plan Project "ACME Basin B," FY2005–FY2006):** The VOW and the District amended the cooperative cost share agreement executed in July 2005 for implementation of source controls or BMPs to increase the total two-year period District share to $99,600.
2. **Race Track Lake Expanded Water Quality Treatment Marsh Project:** The District issued an ERP modification including the Race Track Lake, which is partially funded by a 2003 cost-share agreement between the VOW and the District. Construction is expected to be complete by the end of WY2007. The schedule for the VOW to initiate construction of this project has been delayed by work relating to recovery from hurricane events.
3. **Acme Basin B Discharge Projects:** Both the District and VOW have made progress in planning, permitting, and design for elimination of direct discharge to WCA-1.
    - The District received FDEP approval on June 15, 2006, for a revision of the Long-Term Plan to include the Acme Basin B Discharge CERP Project funding in order to expedite the completion of the project. The flows diverted from direct discharge to WCA-1 will eventually be routed west through STA-1E flowing to WCA-1 after treatment.
    - The VOW has received approval for modification of the master stormwater management system (ACME Improvement District Basin B Long-Range Plan Project) permit to complement the Acme Basin B Discharge CERP Project. The system modifications require substantial improvements to the existing conveyance system to enable the diversion of flows from Basin B into Basin A, and then into the C-51 West canal.

Anticipated Activities for WY2007

1. **Acme Basin B Discharge Projects:** The District will begin the construction of the ACME C-1 Canal and Pump Station #7 portion of the Acme Basin B Discharge CERP Project in July 2006. The District is anticipating the diversion of VOW discharges historically made directly to WCA-1 by December 31, 2006. A second phase will incorporate 374 acres within Section 24, west of the VOW, for future use in the project as a wetland area with floodwater storage capability and environmental feature. More detail on this project is available in Chapter 7A of this volume, at the CERP web site (www.evergladesplan.org), and the Acceler8 web site (www.evergladesnow.org).
2. **BMP Cooperative Agreement (Long-Term Plan Project "ACME Basin B," FY2005–FY2006):** The VOW will finalize and implement a BMP plan related to the July 2005 cost-share agreement. Anticipated uses of the funds are expanded public information and education initiatives as well as cleaning of canal bottoms to remove accumulated sediment to further improve the quality of water from this basin.

BOYNTON FARMS BASIN UPDATE

WY2006 Phosphorus Results for Boynton Farms Basin

The Arthur R. Marshall Loxahatchee Refuge headquarters property, which is considered part of the EPA although outside the eastern boundary of WCA-1, receives discharges from this basin but no discharges from this basin reach WCA-1. Water quality grab samples for the discharges from this basin have been collected by the District from April 2000 to the present on a limited number of flow events.

No samples were taken in WY2006 due to minimal rain during the growing season and crop damage from Hurricane Wilma limiting pumping. Information regarding historical flow data from these properties is not available to the District; therefore, FWM TP concentration and load data from this basin to the EPA are not available. A summary of the upstream water quality data and a map of the Boynton Farms basin depicting these sites are available in the Non-ECP Upstream Monitoring WY2006 report on the District's Everglades Regulation Publications web site.

Source Control Strategy

The WQIP for the Boynton Farms basin consists of a combination of agricultural BMPs required by lease agreement, voluntary BMPs, and integration with the Palm Beach County Agricultural Reserve Water Reservoir CERP Project. This CERP project, currently scheduled to be completed after 2015, includes using all or a portion of the lands within the Boynton Farms basin as a buffer and north to south conveyance, eliminating discharge to the EPA.

Update on Source Control Activities for Boynton Farms Basin

Summary of WY2006 Activities

During WY2006, the District and stakeholders continued the implementation of the WQIPs for the Boynton Farms basin, as detailed in Chapter 3 of the 2006 SFER – Volume I. The District performed an evaluation of alternatives for redirecting discharges to the west from the basin. The objective of this study was to compile existing basin characteristics and provide landowners and

stakeholders with schematic design and cost alternative options for eliminating high nutrient discharges to the EPA. The final Preferred Alternatives Evaluation and Cost Estimates report (Scheda Ecological Associates, Inc. 2006) can be found on the District's Everglades Regulation Publications web site. This document was created with stakeholder involvement and provided to basin landowners and stakeholders to aid progress in meeting water quality goals for discharges to the EPA.

Anticipated Activities for WY2007

The Palm Beach County owned property is under a new lease agreement with requirements for BMPs that are being coordinated through the PBSWCD. The lessee has filed the Notice of Intent to Implement BMPs in accordance the Vegetable and Agronomic Crops BMP Program adopted by FDACS and, in cooperation with the PBSWCD, is monitoring the BMP implementation and compliance. In addition to agricultural BMPs, the county is evaluating options to make structural changes to the surface water management system to eventually allow discharge east to the Lake Worth Drainage District system instead of to the EPA.

FUTURE DIRECTION FOR THE NON-ECP BASINS

As noted in the Long-Term Plan, continued implementation of BMPs in the non-ECP basins is necessary to ensure progress toward improving water quality in discharges until future construction projects to impound or divert discharges are completed. In the meantime, cooperative efforts are under way in each basin to optimize the BMPs and other source control activities described in the WQIPs. As essential construction projects are delayed, the District will apply for amendments to the Long-Term Plan to update the recommended schedules and strategies to reflect current conditions and to request additional funding to continue the existing source control projects for the interim periods. The District will continue to track the progress of the construction projects and coordinate with local governments, the 298 Districts, the Seminole Indian Tribe of Florida, the Miccosukee Tribe of Indians of Florida, and other state and federal agencies.

The District will optimize the existing monitoring plan for the Feeder Canal basin and evaluate TP data to determine water quality trends and contributing factors. Additionally, the District will work with landowners within the basin to ensure compliance with storm water system permit requirements and to develop additional BMP implementation alternatives.

It is anticipated that the non-ECP permit will be renewed in December 2006 by the FDEP to establish long-term compliance permit requirements and define water quality standards through technology based effluent limits (TBELs) for each basin. Water quality improvements to achieve TBELs will be accomplished through the basin-specific WQIPs (as described in Chapter 3 of the 2006 SFER – Volume I and as updated in previous sub-sections) that include a combination of BMPs, diversion strategies, and capital improvement projects. This is consistent with the requirements of the Long-Term Plan for these basins, which indicates substantial reliance on source controls and full integration with CERP and other local construction projects.

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